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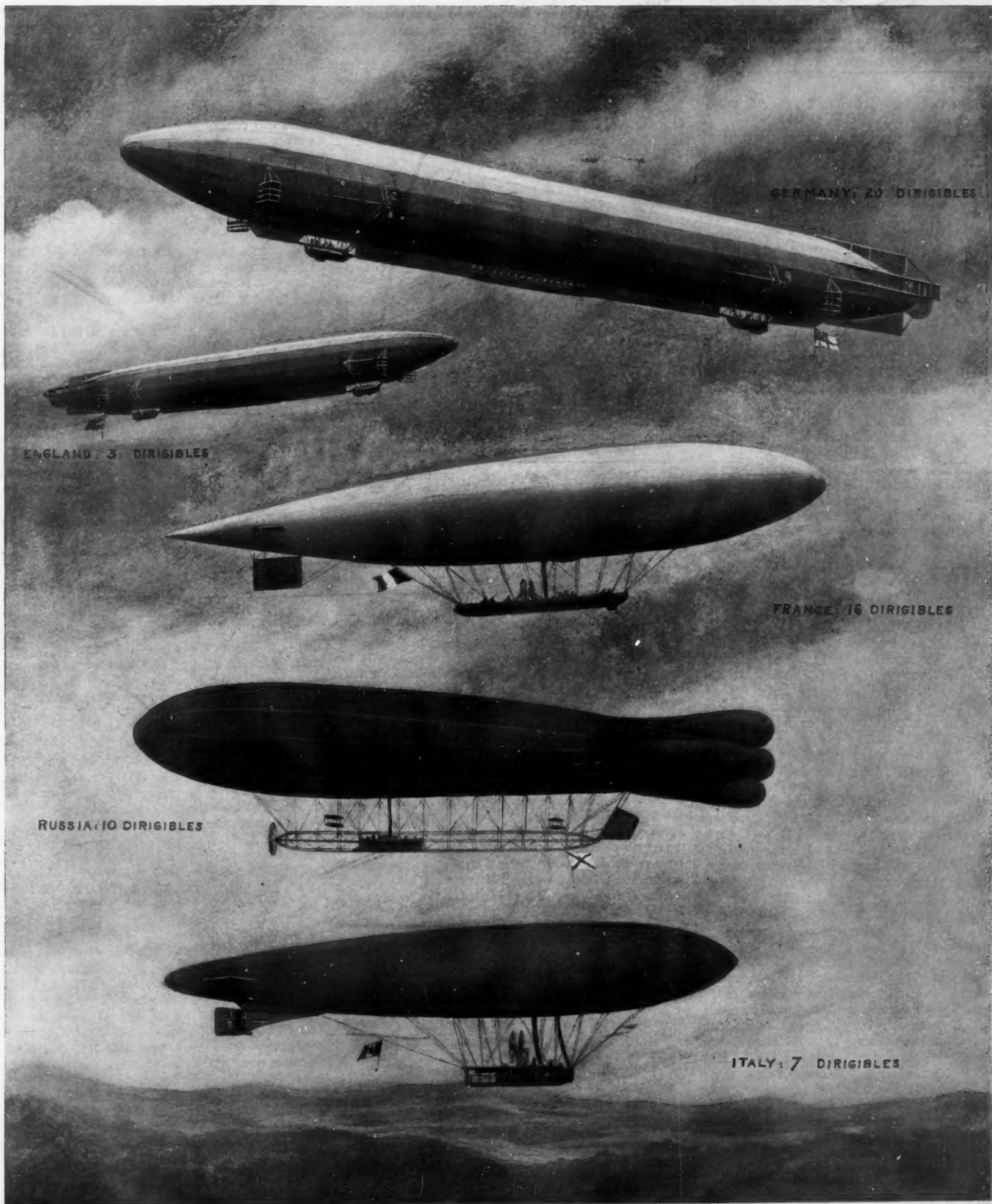
SCIENTIFIC AMERICAN

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The relative sizes of the airships here pictured indicate the aerial strength in dirigibles of the leading European military powers.
THE MILITARY SUPREMACY OF THE AIR.—I.—[See page 550.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Automatic Railroad Stop

THE propaganda of "Truth" which the New York, New Haven and Hartford Railroad Company is carrying on through its president, Charles S. Mellen, is something unique in the history of railroads. Commencing with the letter of Vice-President McHenry in our issue of November 16th, replying to our article of October 26th on the Westport wreck, these Bulletins of truth (for whatever they should rightly be called) by the railroad company, have been continued in the public press in a series of large-type statements headed "Truth" and numbered consecutively. Acting on the suggestion of the Interstate Commerce Commission that "railroads ought to unitedly experiment with the automatic train stop until a device of practicability of general use shall be available," Mr. Mellen announces in his third bulletin that a reward of \$10,000 will be paid to whoever shall first invent an automatic device that will safely arrest an express steam locomotive that has passed the danger signal.

We congratulate Mr. Mellen on being the first prominent railroad official to recede from the altogether untenable and illogical position which has been held for many years by railroad men, on the question of the automatic stop and other devices designed to take the operation of trains out of the hands of careless employees at the critical moment and automatically safeguard the lives of the passengers. The railroads have claimed that automatic railroad operation induces carelessness, the employees depending upon the automatic devices and ceasing to exercise that vigilance which is required of them. This extraordinary attitude cropped up during the Interstate hearing on the Westport disaster, when the New Haven officials stated that the introduction of easier cross-overs would make matters worse, since they would tempt the engineers to run over them even faster than they were now doing. Mr. Mellen evidently is still of that opinion; for in his "Truth" No. 2 he says: "Had the cross-over (10) been a No. 20 the result would have been the same"—a statement the fallacy of which any high-school graduate, of average intelligence and with an elementary knowledge of physics, would prove to Mr. Mellen's satisfaction in a few minutes time. If "the result would have been the same," why in the world is Mr. Mellen giving orders to replace the No. 10 by No. 20 cross-overs on his line, as he tells us he has done in the very next paragraph of "Truth" No. 2?

However, we are greatly encouraged to learn that at least one great trunk railroad is prepared to install the automatic stop, if one that is practicable under all weather conditions can be designed; for this means that when a home signal, set at danger, says "Stop!" trains will stop, and will wait until the signal arm has dropped before proceeding into the next block. At present the engineer stops, and, by permission of the railroad, is allowed to advance "cautiously" to find out where the obstruction is. He is expected to do this, without running into the broken rail or the track wrecker's obstruction or the stalled train and so making confusion worse confounded. Sometimes he succeeds and sometimes there is a collision.

The railroad officials do not like the automatic stop. They fear that it will "slow down" traffic. They believe that the fundamental principle of safety embodied in the phrase "no two trains in the same block at the same time" is unworkable. They will tell you that the home signal may be at danger because the electric apparatus governing the automatic action is out of order, and that in this case the train might be held up indefinitely. In answer to this, it is sufficient to say that a simple telephone line extending from the signals

to the dispatcher's office would enable the conductor quickly to ascertain the facts.

That the automatic stop is practicable in every way, that it is safe, accurate and not an interference with the operation of a dense, fast traffic, is proved beyond all dispute by the results obtained on the New York Subway, where the stop has been installed for many years. Signal Engineer J. M. Waldron, of the Interborough Company who operate the subway, tells us he is satisfied that, with slight modifications, the automatic stop as used in the subway could be applied to trunk railroads operated by steam—and surely this gentleman ought to know.

Let us look at results on the subway, which in regard to the density of traffic, and the small headway of 1 minute 43 seconds under which trains are run, presents the most difficult problem of operation by block signals in the world. Recently, during six days, this system carried 6,505,000 passengers. Of this vast total from 70 to 75 per cent was rushed over the express tracks at speeds of 40 to 50 miles per hour, under the protection of the automatic stop, and of course, of the automatic signal system. The record of signal and automatic stop failures shows that signals have failed once out of 401,115 movements and that the automatic stop has failed once out of 277,846 movements. In other words, there has been one signal failure in about three years and one automatic stop failure in a period of over two years.

Of course this wonderful record is due partly to the fact that the signals and stops operate under ideal weather conditions, being under shelter. For steam road operation some modifications would be necessary; but as the result of an investigation which we have made among signal manufacturers and railroad men who have had wide experience, the conviction is borne home upon us that, if the railroads really wish to install the automatic stop, if they are willing to spend ten times \$10,000 for experimental work that might be required of them or of any individual inventor, and if their eminently qualified staffs will assist in the development of a suitable device, they will not have to wait till 1915 to find the desired mechanism. This \$10,000 offer will help; but is nothing compared to what the railroads themselves might do, if they would take a leaf out of the book of the General Electric Company, whose counsel testified recently in Washington that the company spent several million dollars in experimental work to perfect the Curtis steam turbine.

The Bureau of Chemistry's New Chief

ALTHOUGH the general public knows very little about Dr. Carl Alsberg, his appointment as the Chief of the Bureau of Chemistry will no doubt commend itself to those who are familiar with his career. He is but thirty-five years old, young enough to bring to his task enthusiasm and energy and old enough to exercise the sober judgment and discretion to be expected of a man no longer in his twenties. His academic training is all that can be desired; for he has studied under brilliant professors of chemistry in the leading universities of Germany and the United States. Indeed, so far as the mere matter of academic qualifications is concerned, Dr. Alsberg is probably better off than almost any official who has been connected with the Department of Agriculture in late years. The importance of that can hardly be overestimated. The Bureau of Chemistry needs as its chief a man who has the correct scientific attitude toward the solution of the highly important problems which are assigned to the Bureau of Chemistry. Association with teachers on both sides of the Atlantic, who have spent their lives in the search of scientific truth, is the most effective way of securing that attitude. Because of these associations and because of his training, we are convinced that Dr. Alsberg's appointment is fortunate for the Bureau and the public.

The duties of the new head of the Bureau of Chemistry will be peculiarly onerous. Dissensions in the Bureau itself, petty jealousies, a public press which has come to believe that food adulterators, rather than the incompetence of the Bureau of Chemistry itself, have prevented the efficient administration of the Pure Food and Drugs Act, and lastly, the supervision of the Referee Board, are perils, the braving of which will test the tact, the courage, and the executive ability of the new chief. We hope that Dr. Alsberg will perform his new functions with such efficiency that it will no longer be necessary to maintain at considerable public expense a Referee Board to check up the work of the Bureau, and that the investigations of the Bureau will henceforth be respected the world over for their scientific trustworthiness.

Sea Strength of the Great Navies

OF the many published estimates of the relative sea strength of the leading navies of the world, probably none is so accurate as that which is issued annually by the Office of Naval Intelligence of the Navy Department. The Navy, through

its naval *attachés* and its naval officers scattered throughout the world, has unusual facilities for gathering information of this kind, and the latest knowledge of this nature, published under date of December 1st, 1912, possesses unusual interest at a time when naval construction throughout the world has assumed such enormous proportions.

Unless the prognostications of naval strategy and tactics have been wrongly made, the fortunes of war in future naval campaigns will be decided chiefly by that modern type of fighting ship known as the dreadnought. Other things being equal, the nation which can put the largest number of these ships into the fighting line will have the command of the sea and the prizes of victory secure within her grasp. Let us, then, give first attention to the question of the relative strength of the leading navies in ships of the dreadnought type. We include both the battleships and the large and fast armored cruisers; and since ships are built and commissioned very rapidly in these days, we will base our comparison upon the combined totals of dreadnoughts, built, building or authorized. We find that England heads the list with 36 such ships, Germany being a strong second with 23, followed by the United States with 13; Russia, 11; Italy, 8; France, 7; Japan, 7; and Austria, 4. The significant fact for us in this comparison is that Germany, than whom we were stronger a few years ago, will within the next few years have 23 dreadnoughts against our 13. And yet Congress was guilty of the unspeakable folly, this year, of cutting down the modest request of the Navy for two battleships to one. We should build three at the very least next year, in order to keep up with our yearly programme.

In battleships of the pre-dreadnought class with mixed armament, the order is England, 40; United States, 25; Germany, 20; France, 20; Japan, 13; Russia, 8; Italy, 8; Austria, 6. In the destroyer class the order of strength is, England, 184; Germany, 131; Russia, 107; France, 84; United States, 56; Italy, 35; and Austria, 18. Of submarines England has 86, built, building or authorized; France, 89; United States, 47; Russia, 39; Germany, 32; Italy, 20; Japan, 16; and Austria, 13.

When all the vessels now building are completed the relative order of tonnage will be Great Britain, 2,478,152 tons; Germany, 1,124,267 tons; United States, 898,435 tons; France, 806,729 tons; Japan, 613,724 tons; Russia, 450,297 tons; Italy, 416,310 tons; Austria, 269,761 tons. Here we see that not only has Germany secured a long lead over the United States, but that France will soon be contending with this country for third place.

We are hearing a good deal just now about the grouping of powers in Europe. Arranging the above figures respectively under the Triple Entente and the Triple Alliance, we find that the Triple Entente will have 64 dreadnoughts, the Triple Alliance 35. The Triple Entente will have 68 pre-dreadnoughts, the Triple Alliance, 34. The Triple Entente will have 375 destroyers, the Triple Alliance, 184. The total tonnage when all ships now building are completed will be: for the Triple Entente, 3,744,088 tons, and for the Triple Alliance, 1,801,420 tons.

Solar Radiation

IT is often stated that astronomy has little or no practical value to-day. However much this may seem to apply to some phases of this most interesting line of investigation, it certainly cannot be urged against efforts made to determine the amount and character of the sun's heat. Every living thing receives the greater part of its energy from the sun. Atmospheric circulation and climate are dependent upon the same source of heat. If, therefore, it will be possible to find the exact amount of heat we receive from the sun; if we can determine whether or not it varies from day to day, and, if so, according to what law; if we can connect solar radiation with climate and weather, it would be of untold value to all mankind.

The Smithsonian Institution of Washington has for many years made special studies on solar radiation and easily ranks first in this regard. Evidence has been brought forward by Prof. C. G. Abbot, director of the astrophysical work of the Institution, that the amount of heat radiated by the sun is not constant. With present appliances, however, it has not been possible to determine whether the whole surface is effective in this or not. In order to attack this problem the Smithsonian Institution is erecting, at its station on Mount Wilson in California, a "tower" telescope, forty feet high. This instrument will be very similar to the 60-foot tower telescope of the Mount Wilson Solar Observatory, a cut of which will be found on page 156 of our issue for February 17th, 1912. The new telescope will also be used in studying the intensity of light from the sky and the reflecting power of clouds.

When completed this instrument will be a powerful means of grappling with some of the great problems of solar physics, and in the hands of Prof. Abbot and his assistants we feel sure of its efficient use to this end.

Engineering

Extending the Galveston Sea Wall.—The present sea wall at Galveston, finished in 1906, which extends for a distance of four and one half miles around the city, is to be extended, at a cost of about five million dollars. It is expected that the extension will provide an elevated area, protected by sea wall, which will accommodate practically double the present population of 41,000.

Panama Canal Excavation.—In spite of a rainfall for the month of October of 14.01 inches, the total amount of excavation at the Panama Canal reached 2,584,823 cubic yards, which works out at a daily average of 95,734 cubic yards for 27 working days. There was placed in the dam 332,531 cubic yards of fill, and 66,754 cubic yards of concrete was laid.

Present Status of Panama Canal Work.—According to the canal record, a supplementary estimate of work that must be done to complete the canal was made November 1st, from which we learn there has been an increase in excavation since 1908 of over 36,000,000 cubic yards. The present grand total of excavation, estimated, is 211,361,000 cubic yards, and on November 1st there remained to be taken out only 28,391,000 cubic yards.

New Commander-in-Chief of the Atlantic Fleet.—Early in January Rear-Admiral Badger, the future commander-in-chief of the Atlantic Fleet, will relieve Rear-Admiral Osterhaus and will hoist his flag on the "Wyoming." This vessel is the latest and most powerful of our dreadnoughts, carrying, as she does, twelve 50-caliber, 12-inch guns, mounted in six turrets. Her presence in the review recently held in the North River made her familiar to residents of New York and vicinity.

A Thirty-five Knot Torpedo Boat.—The British destroyer "Lurche," during an official sea trial of eight hours, achieved a mean speed of 35.34 knots, or 3.34 knots above the contract speed of 32 knots. The trial, of course, was run in deep water. The "Lurche" is one of three destroyers 265 feet in length by 25 feet 7 inches in beam. They are driven by twin Parsons turbines, and these vessels will constitute the fastest of their class in the world.

Oil Engines in the British Navy.—The fact that five different sets of marine oil engines are being constructed for the British navy, shows that the Admiralty is taking up the question of the best type of marine oil engine with characteristic thoroughness. One set will be of the Fiat type, another will follow the principle of the Nürnberg type, two of the other sets are to be low-speed engines and the fifth is to be of the high-speed type. In all cases the engine will be of the four-stroke cycle, reversible type, and the power will range from 500 up to 2,500 brake horse-power. Various types of auxiliary installation will be tried out. The auxiliaries on one ship will be driven by small-tube steam boilers, and in the other cases compressed air or electricity will be utilized. The resulting data will be of the greatest value.

Electrifying the New Haven Railroad.—For several years the electrified zone of the New Haven Railroad, extending from Woodlawn to Stamford, has been in successful operation. The company is now engaged in extending the zone as far as New Haven, and it is expected that this section will be open by July 1st, 1913. The new work will embody such improvements as have been suggested by the experience gained in operating the existing stretch of track. One of these will be a rearrangement which will eliminate the effects of electro-magnetic induction on adjacent telegraph and telephone systems, which heretofore caused much trouble and interruptions in service. It will be remembered that the overhead line carries a pressure of 11,000 volts.

Award of John Fritz Medal.—Founded in 1902 in honor of the ironmaster whose name it bears, the John Fritz Medal has been awarded for this year to Capt. Robert W. Hunt of Chicago. The medal is intended to commemorate notable scientific and industrial progress. Capt. Hunt, an engineer of world-wide celebrity, served in the Civil War from 1861 to 1865, and has been widely known for his work in many branches of engineering. Previous awards of the medal have been made to Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Charles T. Porter, Alfred Nobel, and Sir William White.

Some Figures of Coal Production.—During the year 1910, the total coal production of four States, Alabama, Maryland, Pennsylvania and West Virginia, amounted to 233,500,000 tons. What this means will be understood when it is stated that the total output for the whole United Kingdom in the same year was 264,300,000 tons. In 1900 the total output for the world was 768,000,000 tons; for the United Kingdom 225,175,000 tons, for the United States 269,675,000 tons, and for the four States named above it was 114,200,000 tons. To-day the world's output has risen to 1,164,000,000 tons. The United Kingdom produces 264,300,000 tons, and the United States 501,600,000 tons; from which it will be seen that the output from the United States is nearly one half that of the whole world.

Science

Dr. George C. Simpson, late physicist of Capt. Scott's Antarctic expedition, has returned to his regular duties under the Meteorological Department of India, after an absence of three years.

Australian Radium.—According to the *London Times*, the first sample of radium bromide produced outside of Europe has just been manufactured in Sydney from Australian ores, and has a certified purity of 98.4 per cent. The plant is capable of producing 40 milligrammes weekly.

The Royal Geographical Society is considering the question of admitting women as fellows on the same basis as men. The same question was raised in 1893, when the council of the society actually elected a number of lady fellows; but their action was not sustained by a majority of the society, and the controversy that ensued resulted in the resignation of the president.

Metallic Sponges.—A Danish scientist, M. Hannover, has invented a metallic sponge, which has recently come into industrial use. It is composed of an alloy of lead and antimony, and consists of a loose-meshed network inclosing spaces of larger or smaller size. It is employed for absorbing resins, oils, etc. A description was given to the French Academy of Sciences by M. Le Chatelier and is reported in *La Revue*.

How to Get Rid of the Odor of Linoleum.—*La Nature* gives the following recipe: Mop the linoleum with a sponge or a piece of old carpet wetted with diluted javelle water (1 to 10). Leave over night, closing all doors and windows; next morning air thoroughly, and over the dried surface pass lightly a mop wet with water containing 10 per cent sodic bisulphite. Leave again over night with doors and windows closed. Next morning wash several times thoroughly with water.

A Magnetic Survey in the Sahara.—The Department of Terrestrial Magnetism of the Carnegie Institution of Washington has dispatched two magneticians, Messrs. Berky and Sawyer, from Biskra, Algeria, to Timbuktu. They are accompanied by a caravan party, and will spend four or five months in the trip, in the course of which important additions will be made to the great body of magnetic data that the department is gathering from unsettled and uncivilized regions of the world.

The Highest Vacuum Ever Attained Experimentally.—We talk rather glibly of high vacua, or even of a perfect vacuum. It is instructive to calculate the number of molecules contained in a cubic millimeter of gas at the lowest pressure on record. W. Gaede has recently succeeded in exhausting a vessel to a pressure of two ten millionths of a millimeter of mercury (four one thousand millionths of a pound per square inch). At this pressure one cubic millimeter of gas would still contain about eight and a half-million molecules—a number equal to nearly twice the population of New York city.

International Measures Against Plant Diseases.—For some time past the International Institute of Agriculture has been urging the idea of co-operation among the nations of the world to check the spread of plant diseases. The only approach to concerted and uniform action in this direction at present is that taken under the International Convention against Phylloxera, adopted by certain countries of continental Europe in 1878. At last the first steps have been taken toward bringing about more general co-operation. A notable discussion on this subject was held at the recent Congress of Comparative Pathology, in Paris, the attendance at which included the foremost plant pathologists of Europe. It was finally decided that the French government should undertake the arrangement of an international meeting of plant pathologists in Rome next April, which will, in its turn, draw up recommendations to be submitted to the general assembly of the International Institute of Agriculture, which meets next May.

For Extracting the Principle of Plants.—A new method of obtaining the active principles of plants in the state in which they exist in the fresh plant is used with success by the French scientist, Prof. Perrot, of the Paris School of Pharmacy, and together with M. Goris he employs a special method of treating plants for medicinal use. In this way he obtains extracts of a different nature from what are given in the usual processes where dried plants are employed. Such extracts can be used to great advantage as they contain the active principles of the plants in a more suitable and unaltered form. Thus, by his process, the leading active principles such as alkaloids or glucosides and diastases are preserved in their complex combinations such as they existed in the cells of the plant, and under this form it is found that their action on the human body is identical with that of the fresh plant. Such combinations are rendered stable by treating the sterilized powder of the freshly dried plant by alcohol so as to make an extract. This is then evaporated in vacuo and then freed from fatty matter, wax or resin, then dried by a cold process. Such extracts are soluble in water. A description of the above method was laid before the Academy of Medicine in a recent paper.

Aeronautics

Garros's New Height Record.—On December 11th Roland Garros made a new height record at Tunis, Algeria, of 5,801 meters (19,031 feet). This new record was made with an 80 horse-power Morane-Saulnier monoplane, which is the same make of machine that was used by Legagneux when, on December 17th last, he made a record of 17,880 feet at Villacoublay. While Legagneux required only 55 minutes to reach this height and descend to earth again, Garros, in attaining 1,152 feet greater altitude, took one hour, one minute, and six seconds. A week later, on December 18th, Garros made a wonderful overseas flight from Tunis across the Mediterranean to Sicily. He covered a distance of 160 miles and landed near Trapani. French torpedo boats were used to guide him, and he flew at a great height.

Omaha to New Orleans by Hydro-aeroplane.—On December 16th Antony Jannus finally reached New Orleans in his Benoist tractor hydro-aeroplane, fitted with a Roberts 75 horse-power two-cycle motor. Jannus has been nearly two months making the trip, which was accomplished above the Missouri and Mississippi rivers. A good part of the distance, which totals over 1,900 miles, he carried a passenger. At the start of his flight Mr. Benoist attempted to keep up with him in an automobile, but he was unable to do so. Jannus made exhibition flights at various places and demonstrated the possibility of touring in a hydro-aeroplane, even under unfavorable weather conditions. Almost every flight he made was either started or finished in the rain. Nevertheless, Jannus persevered and finally reached his goal without having experienced any severe accident. The Benoist biplane is fitted with a monoplane body, and has a novel feature in the form of warpable balancing planes located between the main planes at each end of the machine.

Aeroplane Flights in the Balkan War.—Almost every day news comes from the scene of activities in the Balkan war of flights made by military aviators. The first Bulgarian aviator to lose his life in this war was Lieut. Tarraxchieff, who was sent out by Gen. Yankoff early in the war to reconnoiter Adrianople. His monoplane went wrong and he crashed to the ground and was killed as the result of his injuries. The Russian aviator, Poppoff, was also killed as a result of his machine catching fire in the air and falling to the ground, and on December 6th Dr. Constantin, the one time assistant of Dr. Doyen, a well-known French surgeon, was shot while making a flight. He managed to descend, and the machine alighted safely at the Bulgarian camp with the dead aviator, who had been shot in the breast, still clutching his control wheel. The barograph showed that he had been up to a height of 4,000 feet. He had flown over a Turkish fort and taken photographs and had evidently been shot in the act. His biplane was riddled with bullets, but this did not seem to affect its flying qualities. Thus once again was demonstrated the necessity of protecting the aviator with armorplate if he is going to engage in active warfare. The only aviator employed by the Turks appears to have been the Frenchman Letort. He made several reconnaissances of two to three hour's duration, and brought valuable information to the Turkish commander. A breakdown to his engine caused him to alight behind the Greek lines and he was captured. The latest cable news is to the effect that on the 19th inst. a Greek aviator, Montoussis, and his passenger dropped many bombs upon the fortified town of Janina, seriously damaging the principal buildings and terrorizing the inhabitants.

Recent Aeroplane Fatalities in England and America.—On the 15th inst. two double aeroplane fatalities occurred in England and the United States. Lieut. Parke, R.N., was carrying a Mr. Hardwick as passenger in his Handley-Page monoplane and flying from Hendon to Oxford. He left the aerodrome at noon and was traveling 50 miles an hour in a choppy wind at a height of some 300 feet when the monoplane suddenly dove to the ground, killing both aviator and passenger instantly. Lieut. Parke was an excellent aviator and had done considerable cross-country flying. Some months ago he faced certain death in a spiral dive from which he miraculously escaped by making what had heretofore been thought to be exactly the wrong maneuver. The American fatalities occurred with a hydro-aeroplane in which aviator Horace Kearney and a newspaper reporter named Chester Lawrence were attempting to fly from Los Angeles to San Francisco. This flight was started over the Pacific Ocean, which had been agitated for three days by a 30-mile gale. Aviator Glenn M. Martin, while searching for Kearney, was nearly drowned also by landing in the rough sea when his motor gave out. A pontoon of Kearney's machine was located first, and several days after part of the wrecked aeroplane was found. The bodies of the two men were finally found nine miles from the starting point. Stopping of the motor and a descent in the rough sea demolished the aeroplane and drowned its occupants. Their fate should be a lesson to all aviators not to attempt foolhardy flights.

The Sing Sing Motor Dumping Truck

EVER since he has been associated with the Department of Street Cleaning of the city of New York, Commissioner Edwards has endeavored to introduce improved methods of collecting ashes, garbage and other refuse. It was apparent to him that the system of using small ash carts with a capacity of a single cubic yard each was not very economical. As a result of very careful tests it was proved that the most economical unit was a truck that would carry nine cubic yards. The Commissioner has also endeavored to displace horses with motor trucks, and experiments this summer proved conclusively that the motor truck offers material advantages over the horse-drawn vehicle in the matter of time and money.

About two years ago the Commissioner visited the State prison at Sing Sing, where there is a shop in which steel dump-carts are constructed by the prisoners. He suggested to the Superintendent of Industry that the Street Cleaning Department of New York needed a motor-driven truck of large capacity, and forthwith the task of building such a truck was undertaken at the prison. The difficulty of this task will be realized when it is known that the 18 or 20 men employed in that shop had never worked on an automobile before and knew nothing about machinery except what they had learned in the course of their labors in the prison. Previous to their imprisonment they had been bakers, bartenders, longshoremen, sailors and laborers. The Department of Street Cleaning informs us that the men took a great interest in the new machine and entered into the work with enthusiasm. Any literature that they could get hold of on the subject of automobiles and their construction was read with avidity, and they spent their leisure hours studying the plans and endeavoring to solve various problems of design. One man, who became ill during the construction of the machine, sent suggestions from his bed in the hospital, and, when dying, said that he would be satisfied if he could live to see the finished truck and ride in it once around the yard.

The machine has only just been completed and may now be seen on the streets of New York, where it is undergoing a rigid test. The truck is constructed of steel and has a body with a capacity of five cubic yards. However, there is a wooden cover over the body which may be piled up with two or three cubic yards more. The particular advantage of the truck is that the body is hung very low, so that it may readily be loaded. To save time, the truck need not be stopped while being loaded, but may travel slowly forward at the rate of a slow walk while the cans are being dumped in it. A novel dumping gear is provided consisting of a worm and sector. The dumping gear is driven by the truck engine through a clutch mechanism operated by the driver. By reversing the gear, the body is returned to its normal position. The cover over the body is provided with a number of doors, so that the load may readily be distributed. Only one of the doors can be opened at a time, so that the dust is confined within the body. This is a great advantage over the carts heretofore used, which have been either open or partly open, and the resultant dust when load-

ing was very annoying to passers-by. At the rear of the cover is a door which opens automatically when the body is tilted to the dumping position. The dumping gear moves the body to an almost vertical position, which is possible because the fulcrum is placed back of the rear axle. The operation of dumping is completely automatic. The entire machine is very staunchly built

is that when this cavity was entered, the tender and resilient pulmonary tissue, no longer protected by the intact chest wall from the normal air pressure of fifteen pounds to the square inch, must needs collapse, so that respiration becomes impossible and death supervenes. The apparatus of the Meyers consists of an outer chamber in which the atmosphere is so rarefied

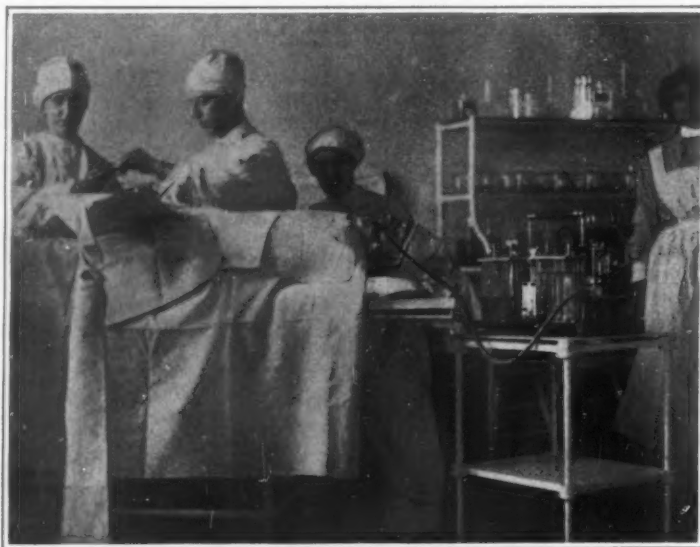
that a negative (—) air pressure results, about equivalent to the atmosphere breathed at an altitude of 1,800 feet above sea level—that is, in cloudland. Inside this negative pressure chamber is a positive (+) pressure chamber in which the atmosphere is denser than that ordinarily obtaining, and which accommodates only the anesthetizer and the head of the patient—the latter's neck being guillotined by a rubber ring, while the rest of his body is in the "negative" chamber. Thus the possibility of lung collapse is still more obviated, the negative pressure upon the torso in the larger chamber being still further counter-balanced by the plus pressure air which the patient's mouth and nostrils are breathing in the inner chamber.

Here is one mode of fortifying the lung against collapse in intrathoracic operations; another method, that of intratracheal insufflation, may be described as follows: Ordinary breathing consists of alternating respiratory movements; aeration of the lungs therefore depends (among other factors space does not permit detailing) upon the intact condition of the chest cavity. During inspiration the circumbient air reaches the smaller bronchi, where the exchange of oxygen and carbonic acid, etc., is effected in the pulmonary "air alveoli" in obedience to the physical law of the diffusion of gases. That superb scientist, Dr. Samuel J. Meltzer, discovered how "the ventilation of the alveolar air can be accomplished through a continuous stream of air passing in one direction instead of the double movements (of inspiration and expiration) in opposite directions." In making some experiments on the mechanism of breathing in the positive pressure apparatus of Brauer, Meltzer and his colleague, Auer, found that if they passed a tube through the larynx of a dog down the trachea (the windpipe) almost to the bronchial bifurcation, and blew air through this tube in a continuous stream, the animal could be kept alive for many hours, even after all voluntary respiratory movement has been paralyzed by curare. By allowing the stream of air

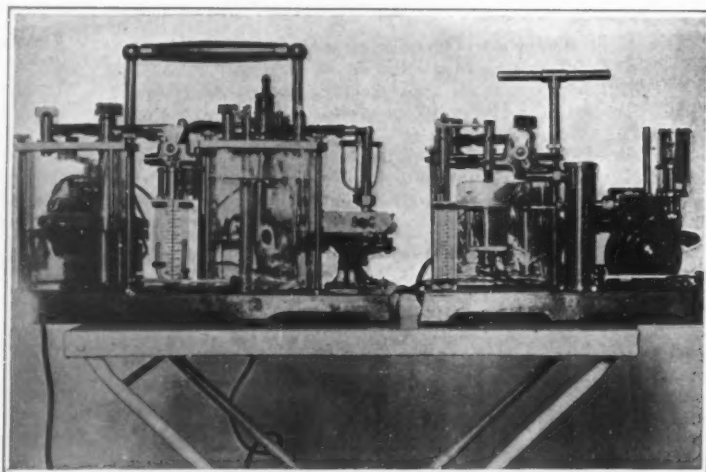
(preferably warmed, as we shall see) to pass over the surface of ether in a bottle, they were able to anesthetize the animals very satisfactorily; and it was possible to open both sides of the thorax widely (the lung remaining uncollapsed) and to have the animals remaining alive for any number of hours. The lungs meanwhile remained moderately distended, the heart action good and regular, and everything as good and comfortable as any self-abnegating canine might desire. The air and ether mixture was blown in at a pressure of 15 to 20 millimeters of mercury.

The only conditions essential to success were that the tube must be of a diameter less than one half that of the glottis (the upper opening of the windpipe), so that the stream of air and ether which passes

(Concluded on page 559.)



The insuflation apparatus in use.



Dr. Janeway's insuflation apparatus.

and the mechanism is practically "fool-proof." So far the tests of this machine have been very satisfactory, and it is quite probable that the city will profit materially from the devoted industry of the convicts.

Dr. Janeway's Insuflation Apparatus

By John B. Huber, M.D.

SOME time ago we considered "cloudland surgery," such as Dr. Willy Meyer does in an apparatus devised and perfected by him and his brother—the latter a mechanical engineer. This apparatus is especially appropriate when operations within the chest are to be done. Until the elaboration of some such apparatus, the thorax has been about the last region of the body uninvaded by the surgeon. The reason



Loading the truck while it is in motion.



Tilting the body to the vertical dumping position.

The Sing Sing motor dumping truck.

Is a Forest a Storage Reservoir or a Stream Regulator?

Effect of Forest Land on Navigable Streams

By Guy Elliott Mitchell, United States Geological Survey

THE United States Geological Survey has announced the results of an exhaustive investigation covering a period of twelve months, which disposes of a problem which has long been a source of contention among scientists as well as laymen; namely, Do forests conserve ground water supply, and do deforested areas result in greater fluctuations in stream flow? In other words, does the forest act as a storage reservoir or a stream regulator? Also, does snow disappear more quickly from deforested than from forested areas? Many scientists, including probably most foresters, and doubtless a great majority of laymen, have assumed the affirmative in all these cases. Nevertheless, there have been many people, among them engineers and other experts of eminent standing and undoubted ability, who have held to the converse—that forest cover has little effect, if any, upon stream flow and related phenomena.

The Geological Survey, after more than a year of field investigations under the Weeks Forest Reservation Act, has finally reported on at least two distinct classes of forest lands, under which must be included a large proportion of our forests, to the effect that the forest and the forest ground cover are important factors in the regulation of stream flow.

The Weeks Act in brief provides that forest land which can be shown to exert an appreciable effect upon navigable streams may be purchased by the Government and created into forest reserves or national forests. The duty of determining this relation between the forests and the navigable streams is placed by the law upon the Geological Survey. Considered for their forestry value, lands cannot be so purchased. Such an act of government was declared by the Judiciary Committee of the House of Representatives some five years ago, to be unconstitutional. Upon the passage of the Weeks Act, therefore, appropriating \$11,000,000, it devolved upon the Geological Survey to make a favorable showing on any and every tract of land prior to consideration of its purchase. The Director of the Geological Survey held that his report in each case must be based on actual field examination and the presentation of scientific data in support of his report.

The Southern Appalachian Mountain forests were first selected as presenting the most promising field, prompt action being required, since the appropriation was made in terms of fiscal years, \$1,000,000 for the first year and \$2,000,000 annually for the succeeding five years, these amounts, unless expended, lapsing with each July 1st. Utilizing what geological and stream flow data were available, field parties were immediately started out, and during the four remain-

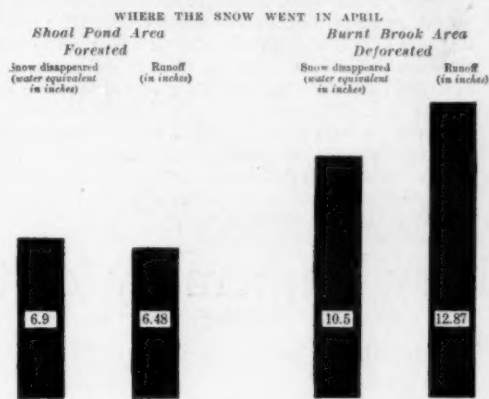
ing months of the fiscal year from the passage of the act in March, 1911, several large tracts of mountain forest land in the Southern Appalachian States were favorably reported on, based squarely upon the principle of protection of navigable streams from the products of excessive erosion due to deforestation and repeated burning of the forest mat or mulch. The dirt and detritus, it was clearly shown, resulting from such forest treatment are washed down into the tribu-

majority of conservationists and nature lovers might believe that the protection of the White Mountain forests would steady the flow of the streams rising therein, but they could state their belief only as a matter of opinion. This was not sufficient under the law. If its provisions were to be carried out both in the interests of the proper expenditure of the Government money which it appropriated, as well as with a view to considering even this large appropriation as only the beginning of a broad governmental policy for the acquirement of great tracts of land in all parts of the United States where navigable rivers head, there could be but one method of procedure to show beyond question a direct and important relationship between forest cover and stream flow.

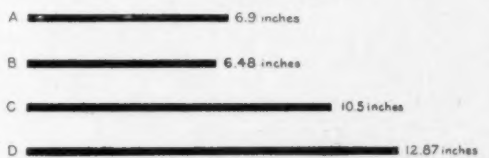
Failing, therefore, to find any excessive erosion in the White Mountains, due to deforestation, the Survey instituted hydrometric investigations in an endeavor to show that deforestation, and subsequent burning of the vegetal forest mulch, does result in a more rapid runoff, and therefore tends to make unstable the flow of streams. In this it has been successful even beyond expectations.

The hydrometric showing presented in the Survey's preliminary report is of results on two small, almost exactly similar, drainage basins on the east branch of the Pemigewasset River of about 5 square miles each, one largely clothed with virgin timber and the other deforested and burned, and is so striking as to render the position of the Survey impregnable. Careful measurements of precipitation over the areas and of the runoff of the respective streams show that not only was the snow held better in the forested area, but that during a period of 17 days in April, 1912, including three extended storms, the runoff in the stream in the deforested area was a comparative flood—practically double that of the stream flowing through the forested area. In Shoal Pond basin (the forested area) the Survey had established seven rain gages and twenty snow gages, the engineers visiting these continually during the winter on snow shoes, the snow being from 4 to 7 feet deep; in the adjoining Burnt Brook basin (the deforested area) it established nine rain gages and eighteen snow gages. On both streams hydrometric stations were established and the stream flows determined with a high degree of accuracy. The stream discharge from the deforested basin was double that from the forested basin, and the maximum flood from the forested basin was only 67 per cent of that from the deforested basin.

During the period of these storms, Burnt Brook (deforested) is shown by the report to have contributed a much greater volume of water to the Pemigewasset



Comparison of two areas for three storm periods (17 days) in April, 1912.



A. Amount of snow disappeared, expressed in water equivalent, during three storms in April, 1912, on the forested Shoal Pond area. B. Runoff of Shoal Pond Brook, same periods and same area. C. Similar snow disappearance on the deforested Burnt Brook area. D. Runoff of Burnt Brook, same periods and same area.

aries and from them find their way into the lower navigable rivers and clog them.

In the White Mountain region, however, physical conditions were found to be different. Geologic investigation could find no basis for the statement that deforestation of the granite slopes of the White Mountains would endanger the navigability of the Merrimac, the Kennebec, or the other navigable rivers of New England. Geological Survey officials along with the



Typical method of ice measurement in the White Mountains. The results of the present actual measurements in the drainage basins of this district, so accurate and refined in method as to approach laboratory experiments where exact effects may be expected, leave no doubt as to regulating stream flow.



One of forty observation stations visited weekly during winter for determining depth of snow and its water equivalent, the latter being found by weighing a sample of snow. Four observers were kept busy on this work in snow up to 7 feet deep, often in high winds and below zero.

River than did Shoal Pond Brook (forested). "The stream of the forested basin is observed to be the steadier of the two, and in proportion to its drainage area it tends—at least during the spring months—to promote a steady flow of water in the master stream of which it is a tributary."

The conclusions of Director George Otis Smith of the Survey are as follows:

"The comparison between two adjacent basins during critical periods is presented in this preliminary statement as a sufficient showing for the purposes of the National Forest Reservation Commission. While data covering longer periods for both these and other basins in the White Mountains have been collected and will be available for the more complete report, the particular case of the Burnt Brook and Shoal Pond basins is typical for the region and establishes the general conclusion that a direct relation exists between forest cover and stream regulation.

"The results of the Burnt Brook-Shoal Pond Brook studies are held to show that throughout the White Mountains the removal of forest growth must be expected to decrease the natural steadiness of dependent streams during the spring months at least. The foregoing conclusion forms a strong basis for arguing the desirability of painstaking methods of administration in respect to forest lands in the White Mountain region. Deforestation followed by fires, as in the Burnt Brook

basin, results in conditions unfavorable to natural spring storage because conducive to rapid snow melting and stream runoff. Control of White Mountain lands that would reduce fires to a minimum and promote normal reforestation must result in a great improvement over present tendencies, and this improvement in forest cover can logically be expected to favorably affect stream regulation to the extent quantitatively indicated in the comparison of the forested Shoal Pond Brook with the deforested Burnt Brook.

"While the intensive hydrometric work was confined to a few headwater tributaries of the Connecticut and Merrimac rivers, the basins studied were selected as typical for the whole White Mountain area, and the field examinations over this region have shown the tracts now under consideration for purchase to be similar to the basins here reported upon. Therefore, the favorable showing of this report is of general application in the White Mountain area."

Such an actual demonstration and quantitative measure of the performance of different areas, some forested and others deforested, has never been attempted in trying to determine the effect of forest cover on stream flow. Efforts to arrive at definite conclusions have always been attempted on a basis of a study of long-time records of precipitation and stream discharge; but owing to the many qualifying factors, these have simply resulted in divergent opinions and incon-

clusive controversies. The results of the present actual measurements in these small drainage basins, so accurate and refined in method as to approach laboratory experiments where exact results may be expected, leave no doubt as to the conclusion. Forest cover and the resulting forest mat in the White Mountain granite area does, to a considerable and measurable degree, steady and regulate stream flow, and therefore must be stated as an important factor in maintaining the navigability of streams whose headwaters lie in such regions.

While the report made by the Survey refers specifically to two small drainage basins, and while the conclusions reached are that the entire White Mountain area is subject to purchase under the Weeks law; nevertheless a large amount of additional work has been carried on in the White Mountains and many additional basins and areas investigated and the results recorded. In fact, the work is not even yet quite completed. As soon as finished, a final report will be made to the Commission, and at the same time a Survey bulletin will be issued which will present the facts in full and also discuss the problem from a scientific standpoint. It is believed that this will establish a fact which has been accepted, believed, and advocated by many prominent men for many years, yet which upon the challenge of equally eminent men, they have never been able to prove.

The Military Supremacy of the Air—I

The Aeronautic Plans of Great Military Powers

By Theodore M. R. von Kéler

A STRUGGLE has begun on the European continent for the military control of the air. No longer a phantasy of the novelist, or a dream of the inventor, the fight for mastery is being waged under the very eyes of wondering Europe. The two combatants, needless to say, are France and Germany; and how far this struggle already has been carried, how many millions of dollars it already has cost, and will cost in the near future, this article will show.

The German Reichstag, in the last week of May, 1912, passed by an overwhelming majority the army and navy bill, with its provision of \$30,000,000 for "extraordinary expenses." The bill contained a "rider" in the form of an appropriation of \$500,000 for the development of military aeroplanes. Small as this appropriation is, it served to electrify France and stir its military leaders into extraordinary activity. The very fact that the methodical, slow Teuton considered it necessary, or at least worth while, to set aside half a million dollars for the "development of aeroplanes," in addition to maintaining huge airships of the Parseval and Zeppelin types, showed more than anything else Germany's determination not to permit France to enjoy any longer its hitherto unchallenged supremacy in aerial navigation.

Other nations were not slow in recognizing the probability of having to fight at least part of their battles in the air, and a feverish activity in the launching of fighting air craft became evident soon after the publication of the French and German budgets. Early this summer the international aerial fleet, exclusive of heavier-than-air machines, consisted of sixty-five "cruisers." Of these, Germany owned twenty; France, sixteen; Russia, nine; Italy, seven; Austria, four; Great Britain, three; Belgium and Japan, each two; and Holland and Spain, each one. Five of the twenty air-cruisers under the German flag are of the rigid type, six are semi-rigid and nine are non-rigid. Aside from these the Kaiser's government has in course of construction two additional rigid airships (Zeppelin type), three semi-rigid of three different types and one non-rigid (Parseval type).

A comparison of the sizes of the various airships in the international fleet shows that the smallest is the "Dundig" of Holland, which has a capacity of 950 cubic meters of gas; while the largest is the German "S.-L. L." (Schütte-Lanz), which is of 19,500 cubic meters capacity, and which has a lifting power of 22,000 kilograms. The Zeppelins are by far the fastest aerial cruisers, possessing a speed of seventy-five feet per second, while the fastest French ships so far have only been able to make fifty-two feet per second, long-distance flights in each case being figured as a basis for the calculation. The new German naval Zeppelin, too, holds the endurance record of over 31 hours in the air, during the course of which it covered 1,300 miles and broke the record of the "Adjutant Reau" of 21 hours, 21 minutes and 56.9% miles, made a year ago.

Early this spring the French Ministry of War asked Parliament for 18,116,540 francs for aerial navigation. Enormous as this sum appears, it was soon discovered that it was entirely inadequate for the needs

of France. Instead of curtailing the minister's demands, the Senate suggested a considerable increase in the "aerial" programme, and a total of 33,231,350 francs was granted for this purpose. In addition, the Ministry of War obtained permission to extend its programme and its demands. The new French law reorganizing the "Fifth Arm" went into effect on March 25th.

Aerial navigation being so little understood and developed at present, it is but natural that no definite rules and regulations worked out into the minutest details have as yet been adopted. The new law is merely a combination of the chief fundamental principles underlying this sort of service. Its most important effect is the segregating of the aerial troops from the railway and engineering corps, as well as from the artillery regiments, with which they heretofore have been combined. The entire organization will be under the command of an inspector of aeronautics, who is directly responsible to the Minister of War.

Military aeronautics, according to this new French law, comprises not only flying in its ordinary sense, but also the study, construction, purchase and operation of spherical, elongated and dirigible balloons, observation kites, aeroplanes and hydro-aeroplanes, and the instruction and mobilization of aviators, aeronauts and observers. The law distinctly provides for the purchase of all military aeroplanes, etc., from private manufacturers in the open market, but permits of all repairs being made in the government shops. The idea, of course, is that private competition in such a new field as aeroplane manufacture brings better results than government work along established lines. Repairs, on the other hand, can be carried out more advantageously in the government shops, where labor is almost free and where expert mechanics are at all times available.

The new French "Fifth Arm" is organized as follows:

Seven companies (each of 3 officers and 108 men) and one transportation company (consisting of 3 officers, 127 men and 133 horses) form the aerial regiments. In addition there are 10 "sections" of 60 men each, which will take care of the actual flying. A separate staff of mechanics is to be selected from the best soldiers to carry out the necessary repairs and to work out improvements in construction.

A provision is furthermore made for a continuous transfer of men from other arms of the service to the aerial corps, so as to diffuse the knowledge of aerial work as much as possible among the rest of the army. This precaution was thought necessary on account of the extreme danger and strenuousness of the work, which few are able to endure for more than three years.

The aerial corps is open to all persons who have graduated from the Ecole supérieure d'Aéronautique in Paris or who have obtained a pilot's license from the military authorities; furthermore, members of aeroclubs and pupils of private aviation schools, who can pass an examination as to their abilities, as well as mechanics and workmen who have been employed in aeroplane factories, chauffeurs, etc. All these may be drafted in the regular way, as are recruits for other parts of the army.

Volunteers are welcomed from other walks of life, but all of them must pass a particularly rigid examination as to their health. Perfect eyesight, good lungs, a good knowledge of gasoline engines and wireless telegraphy are essential. Only officers will be graduated as pilots of single-seated aeroplanes, petty officers and men being restricted to the position of mechanic or pilot of aeroplanes with more than one passenger. Officers, whose duty it is to familiarize themselves with the work of the aeroplane corps, such as members of the general staff, artillery, etc., are taken on board the aeroplanes as observers.

(To be continued in next week's issue.)

THE LIST OF FRENCH DIRIGIBLES.

No.	Name.	System.	Length. (meters).	Cubic Contents. (cubic meters).	Motor Power.
1	Liberté.....	Lebaudy.....	66	4,200	1 of 100 horse-power
2	Col. Renard.....	Astra.....	69	4,800	1 of 120 "
3	Capt. Marshal.....	Lebaudy.....	85	7,500	2 of 110 "
4	Le Temps.....	Zodiac.....	51	2,500	1 of 70 "
5	Adj. Vincent.....	Clément-Bayard.....	88	9,000	2 of 200 "
6	Adj. Reau.....	Astra.....	86	8,950	2 of 120 "
7	Capt. Ferber.....	Zodiac.....	76	6,000	2 of 90 "
8	Selle de Beauchamp.....	Lebaudy.....	70	6,000	2 of 75 "
9	Lt. Chauré.....	Astra.....	83	8,850	2 of 120 "
10	Comm. Couëtelle.....	Zodiac.....	80	9,000	2 of 190 "
11	Gen. Meunier.....	Lebaudy.....	95	10,000	3 of 135 "
12	Clément-Bayard V.....	Clément-Bayard.....	88	9,000	2 of 140 "
13	L'Éclairer-Conté.....	Astra.....	65	6,640	2 of 75 "
14	Spiss.....	Zodiac.....	104	11,000	2 of 200 "
15	Le Fleurus.....	(specia.).....			
16					
17					
18					
19					
20	Five ships of not less than 8,000 cubic meters planned, of a type similar to Astra (No. 13)				

THE FRENCH BUDGET FOR AERIAL EQUIPMENT.

Expenses for.	Regular 1912.	Additional.	Total.
Men.....	877,940 francs	1,064,810 francs	1,942,750 francs
Aeroplanes.....	11,200,000 "	11,050,000 "	22,250,000 "
Airships.....	6,038,600 "	3,000,000 "	9,038,600 "
Total.....	18,116,540 francs	15,114,810 francs	33,231,350 francs

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Free-toll Canal Absurdity

To the Editor of the SCIENTIFIC AMERICAN:

It certainly seems strange that we Americans, after spending \$500,000,000 in making the Panama Canal a reality—for within the next ten years that amount of money will have been paid out from the U. S. Treasury on account of the canal—are so simple-minded and so unbusinesslike as to allow, year after year in the future, untold millions to go into the pockets of steamship owners rather than back into our own Treasury.

It is planned that all this money that the owners of American coasting vessels should pay to the American people is to go into the pockets of these vessel owners; just so much more in dividends to divide among the stockholders.

Are we encouraging American shipping by allowing American coasting vessels free passage through the canal? Is the great and glorious American mercantile marine service to be revived and given new and endless prosperity by escaping the payment of a toll of this kind? Not a bit of it!

The men who control the various steamship lines, and others who are planning to operate new lines and make use of the canal, are all prepared and ready to pay a toll for the passage of their vessels through the canal. If it should be decided to-morrow to make all American vessels pay to pass through the canal, it would not change the plans of the existing companies, or of the individuals who are planning to enter the business in competition with existing lines, one particle. The entire trade will be in the hands of a few corporations. If they and their stockholders have to pay a toll to the American Government, as, of course, they should, it means so much less profit per annum to them, less cash to divide among the combine, but it also means that the American people have got just that same amount of money paid into the U. S. Treasury, and not into the pockets of a comparatively few already wealthy individuals.

The idea of the American nation spending \$500,000,000 and letting the steamship companies cripple the earning power of the canal, and putting those tolls into their private pockets instead of benefiting the entire country by paying these sums into the U. S. Treasury, is simply monstrous! What benefit is the American nation getting by allowing millions of dollars in tolls to go into the pockets of a few millionaires? As a result of free passage through the canal, are these steamship corporations going to make a reduction in freight rates? Well, hardly. As a result of this elimination of tolls, do we hope to induce the men in the steamship business to use the canal? Are we afraid that a toll will scare them off? Is it a kind of national subsidy or encouragement for Americans to invest in the shipping business? No! Everybody who has occasion to use the canal is going to use it, toll or no toll, and the payment of a proper toll is not going to cause them to fail, or go out of business, or discourage them from building new ships. Is it supposed to be patriotism, or just pure generosity, or what in the name of reason is it, that makes certain individuals at Washington and various newspapers declare that millions of dollars that should by right be added to the national wealth every year, had better be turned over to swell the fortunes of a few individuals?

It certainly would be an edifying sight to stand on the bank of the canal and watch ship after ship, some going east and some going west, all owned by American corporations in coast trade (and manned mostly by foreigners) passing through free of expense. A good half billion dollars spent by the U. S. Government; the canal and its entrances choked with free ships; and 90,000,000 or more Americans wondering why the few corporations that own these ships should be allowed such an unjust privilege! Is that a businesslike way to run any enterprise?

How are expenses to be met? Oh, that's easy. There is plenty more money in the Treasury, and then we will soak foreign-owned ships, and Yankees as well, who have been so unfortunate as to own ships engaged in commerce with other countries. Their ships happen to be loaded with cargoes for Callao or Hong Kong instead of for San Francisco or New York, and you bet we'll make them pay for going through the canal!

Now that is logic, isn't it! The fact is, that this whole free-toll business has been engineered by powerful interests, who hope to fatten their bank accounts with the millions that rightly should go to the U. S. Treasury. England has protested, and rightly. The wording of the treaty that she calls to our attention is perfectly plain, and for any true American to try to interpret it differently is to invite suspicion and

scorn from all civilized nations. To reply to England that the canal was built with American money and is ours, and that we shall do what we like with it, is childish in the extreme.

As it looks now, we shall not do as we like with it. Far from it; for the great benefit will accrue to a few corporations only. It is impossible to conceive that any such absurd proposition should continue in force very long. If this free-from-toll scheme for coasting vessels is allowed, there will be a great howl later on, when all the people begin to realize that they have been fooled. Now is the time to save ourselves from becoming more ridiculous than we already are.

During the past few years our moral perspective and sense of obligation seem to have become rather twisted and out of line; in fact, from the very beginning of this canal business; and he who has shouted himself hoarse about "fair play" and "a square deal for everybody" has publicly boasted about the part he played in buncing Colombia out of Panama. We have refused to entertain Colombia's plea for arbitration, because we know she is a weak nation and helpless to enforce her rights. Let us hope, however, that the coming administration will acknowledge the mean trick that was played on a sister republic, and that she will receive proper reparation. Those who attempt to defend the attitude that we have taken toward Colombia give as an excuse that "we got the canal, anyway." Let me say, and everyone who understands the situation at that time will agree with me, that we would have had it just the same by adopting fair and honorable means. Let us beware how we treat England in this present dispute, for she can humiliate us, while poor Colombia cannot.

Newton Center, Mass.

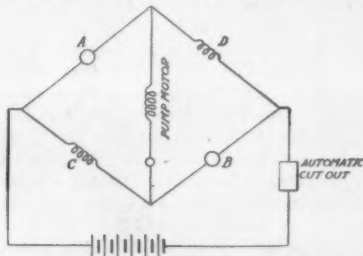
H. M. W.

Farm Electric Lighting by Wind Power

To the Editor of the SCIENTIFIC AMERICAN:

The article on "Farm Electric Lighting by Wind Power" in the SCIENTIFIC AMERICAN for September 28th is a good one. Having had a few years experience with a somewhat similar plant, perhaps it may be of interest to compare notes.

My own plant is of even smaller capacity than Mr.



A pump in the windmill power circuit. A and B commutators, and C and D field windings of dynamo.

Forest's, but that is due mainly to the expense involved. I have tried many experiments in attempting to find a satisfactory way of charging batteries; among others I have tried that of putting the batteries in series with a motor used to drive a pump, so that the windmill had to furnish power to run the pump as well as to charge the batteries at the same time. While this arrangement worked well enough to permit of charging several home-made cells for the first time—which, of course, required many hours of charging—yet the experiment of rewinding the dynamo, so as to charge the batteries without having the pump motor in circuit, was made.

The result of this change was a decided speeding up of the windmill, but on the whole it was a great improvement, as the system required less attention. Oiling is about all that is necessary.

Mr. Forest's plan of using a quarter-turn belt from windmill to dynamo looks good, as it should reduce both noise and friction. While at this season of the year there is often more power than one can satisfactorily take care of with such a plant, there are times when such improvements as a ball bearing at the foot of the vertical shaft, and a pair of universal joints near the top of that shaft to take care of the slight bend which would otherwise be made by the weight of the tail of the windmill, will show a surprising difference in the speed of the windmill.

As to using two pulleys, to allow for variations in the speed of the wind, my experience has been that at times when the wind velocity is low, and a large pulley is accordingly being used on the windmill, there is sometimes a gust of wind of short duration which is severe enough to speed the armature up and make the wires burst from the slots. Since re-winding the armature several times, I have wedged the wires in, and use only the smaller of two pulleys on the windmill. Even now the speed is at times enough to make one fear for the armature winding.

Mr. Forest's plant does not include a pump; there are some difficulties in belting a pump to a power windmill, for if geared so as to pump with efficiency in light winds, speed and noise will probably be excessive in heavy ones. The diagram shows a method of avoiding excessive

speed of a pump without cutting down its efficiency at low speeds of the windmill. After the pump reaches a certain speed, charging current passes into the batteries. Both the pump's speed and charging current are automatically limited, without the use of mechanism likely to get out of order. If the field windings C and D are of low resistance, and if automatic cutout is efficient, there will be no danger of the motor's speeding up to bursting point if the belt slips.

I have tried an experiment which leads me to think that the above scheme is as good in practice as it looks in theory. Of course, the windmill may speed up considerably in very high winds, as the load on it is limited, but it will not speed up quite so much with a heavy load as it would with a light one. Of course, if it were not for the expense, it might be better to increase the load by increasing the size of the battery. In this case, an ordinary shunt-wound motor might be used to drive the pump, current being taken from the battery.

In the article referred to, something was said about reversing the polarity of the dynamo. It would seem that this ought to be impossible; certainly some systems are such that a reverse current from the battery would only strengthen the dynamo field.

As I remember it, you published an article on German windmills for charging storage batteries some years ago. Judging from the illustrations, excessive speed was prevented by dividing the blades of the windwheel into sections, which were connected together and operated like the shutters of a window blind. Presumably, when the speed reached a certain limit, centrifugal force caused the "shutters" to open and let the wind pass through. Just how satisfactorily this worked was not stated; if no better than some other windmills, the windmill would stop entirely after the automatic speed limit came into play. Then it would gradually speed up to a considerable speed, then stop entirely, etc.

EDWARD A. FINCH.

Sound Beach, Conn.

The Gift to the City of Evansville

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 7th, page 480, under heading of "A Curious Gift to the City of Evansville," there is a typographical error that might cause some confusion. It is stated that \$1,000 placed at 4 per cent interest per annum, compounded semi-annually, in 250 years would aggregate \$90,956,400.13. It should be \$19,956,400.13. The calculations in this transaction were made by Mr. C. L. Delbridge, the St. Louis mathematician, for the parties to this contract. I have talked with him many times about it, and herewith inclose a booklet in regard to same, issued by the company for whom he is the official mathematician, in which the amount is given as \$19,956,400.13.

St. Louis, Mo.

W. F. COLLINS.

Landing Aeroplanes from Warships

To the Editor of the SCIENTIFIC AMERICAN:

The daily papers of November 13th, 1912, describe a successful test of a launcher for flying machines which took place at the Washington navy yard on the 12th.

All who are interested in the improvement of the aeroplane may well congratulate themselves that the subject of launching, which has so far received comparatively little attention, is now coming to the front.

It is now recognized by the authorities that, if the aeroplane is to be used for naval scouting, it must be able to take flight not only from the water but also, under some conditions, from the very restricted area which can be spared on a ship's deck.

Various forms of launchers have been invented. The first successfully used was the "tower, weight and tackle," familiar to all who witnessed the earlier flights of the Wrights.

Among other inventions are launchers using (a) the energy of compressed air, (b) atmospheric pressure acting in a vacuum tube, and (c) an endless cable which is a much abbreviated form of the cable formerly used on street railways.

From what has been written upon the subject by the naval authorities, it may be gathered that, in a launching apparatus, the navy needs one which will in no way be a nuisance when a ship is in action. The number of parts should be as few as possible, the apparatus must be one which can be quickly taken apart and stowed in a small compass.

It seems probable that as time goes on, naval architects will be working in co-operation with the inventors of aviation apparatus. When it is considered that in the modern ship of war nearly every space is already utilized, it would seem that in moments of stress any aviation apparatus may prove to be an intruder.

If it be the opinion of naval architects that in a battle or in the preparation for battle, when the order comes to "Clear decks for action" aviation apparatus will be a nuisance, it will be a gain if they will say so. That will hasten the time when one of our older ships of moderate size may be devoted exclusively to aviation, serving as a parent ship for aeroplanes.

JAMES MEANS.

Boston, Mass.

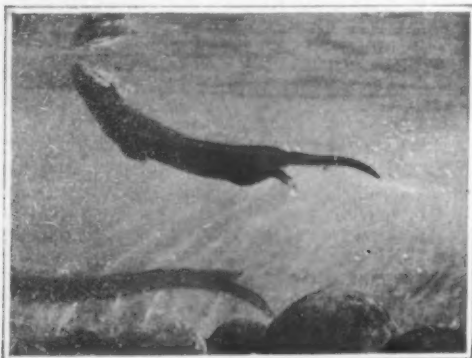


Illustration.
Otter returning to the surface with its prey.

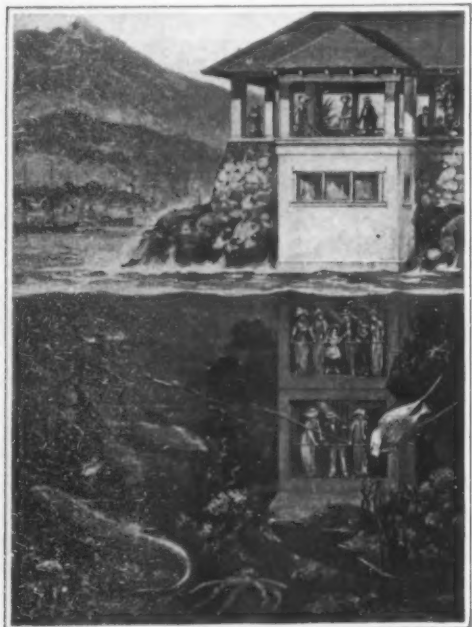


Illustration.
Arrangement of observation chambers designed for a Honolulu hotel.



Contrivance for photographing with the operator above when the water is disturbed.



From Marvels of Fish Life, (Cassell & Co.)
Photographing fish in tank with light from two sides.

Aquatic Life in Its Own Setting

A New and Fascinating Territory Opened to Nature-students

APPARATUS like those devised by Dr. Francis Ward, an English student of zoölogy, suggests some quaint reflections on the methods which mankind has been following for countless generations in studying the appearance and movement of fishes and aquatic animals. It is almost as if we had been forming conclusions on the shape, color and movements of horses or of sheep solely upon our observation of the drowned corpses of such quadrupeds. A fish out of water is not himself, no matter if he be still gasping on the bank, freshly hooked: his color, for reasons which Dr. Ward lucidly explains, is a constantly varying function of his immediate surroundings; the pose of his fins can never be the same out of water as it is under hydrostatic pressure; and all this is over and above the difference between the study of things alive and dead, in their own habitat and in captivity—the difference which has made the contemporary sport of "hunting with the camera" such a valuable aid to biological study.

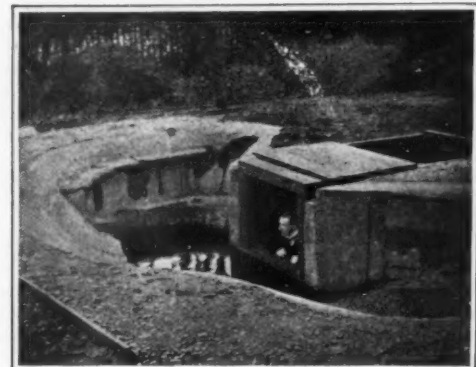
For the aquatic form of camera sport, it was first necessary that a highly specialized apparatus should be constructed. First, Dr. Ward had a pond made, in which he arranged, for the subject of his study, conditions exactly like those to which they would be accustomed in any piece of water where they might naturally be found. But all the sides of this pond are built of concrete and in one wall, as he describes it in his "Marvels of Fish Life, as Revealed by the Camera" (Cassell & Co., Limited), is an observation chamber separated from the water by plate glass. "Concealed in the chamber, the observer can watch the fish as they appear to each other in the water. In consequence of the darkness in the chamber and the light in the pond, the glass is converted into a mirror, and the fish merely sees himself and his surroundings reflected, while the observer can plainly see into the pond. It is thus possible to observe a timid fish without disturbing him." The light by which the fish are seen is, of course, that which penetrates from the surface of the pond, and this illumination, at least so far as three feet below the surface, is sufficient to enable the concealed observer to take instantaneous photographs of the totally unsuspecting creatures as they live their own mysterious lives in their own environment.

Some of the results obtained will be startling to persons of only ordinary information on the subject. For instance, fishes are generally supposed to be creatures devoid of emotion, or at least very undemonstrative; but the frontispiece of "Wonders of Fish Life," an exquisite bit of color photography, shows a perch "paling with fear." This particular study was the climax of a fish drama (more really satisfying than the old-fashioned tank drama) which Dr. Ward watched from his place of concealment: the perch had audaciously swallowed a worm on which a great big rainbow trout had his eye, the trout had seen him do it, and the perch had just found out that the trout had seen—hence the pallor. Then Dr. Ward tells some interesting things of a pike which he photographed through a series of emotional moments. At one of these moments the pike "rests motionless on the bottom, with his body just off the ground, supported on his fins. That the pike is on the watch all the time is evident from the keen look in his eye. Suddenly, without any movement of the body or other fins, the fin on the back will become erect and fully extended, a sure sign of mental agitation." This is when he catches sight of his prey, a dace. The third dramatic moment is when he is on the point of charging down on the dace, and lastly we are shown "a disgusted and disappointed fish," when the dace has disappeared.

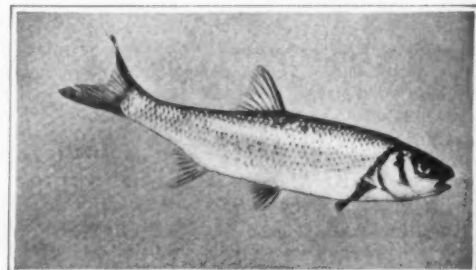
Perhaps of more definite importance in a scientific sense, if only because more clearly demonstrable, are the facts brought out by Dr. Ward as to the defensive coloring of fishes. Some of the illustrations given in "Marvels of Fish Life" are not only convincing evidence of the aid to concealment afforded the weaker species by the peculiar reflecting power of their skins, but also testify to the effective working of photography in the special circumstances of Dr. Ward's observation pond. To exhibit the various effects of light on the fishes' bodies, the investigator has also used an



Illustration.
The same otter in pursuit.



From Marvels of Fish Life, (Cassell & Co.)
Dr. Ward's pond before filling, showing observation chamber.



Dace, showing its dark back, silvery side and white under-surface. As depicted in books.

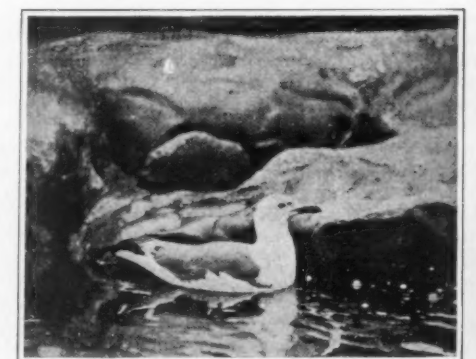


Illustration.
Gull at rest on the surface.



Illustration.
As the fishes see a gull entering the water—fish swimming straight down.

apparatus for taking photographs of his subjects in small tanks with light admitted only from the front and above. With this apparatus and an arrangement of black sticks placed in the tank, and over which a dace was cleverly induced to pause for a moment, a very good demonstration has been obtained of the wonderful effect of the numerous "mother-of-pearl-like spicules" in the deep layers of the skin, which make this fish a perfect living and swimming mirror.

Then, to investigate the ways of fishes which inhabit waters outside of Dr. Ward's private pond, and far from its observation chamber, he has contrived a very ingenious portable apparatus which is here described in his own words: "When using the camera above the surface of the water, it is necessary to use some form of apparatus which cuts off the light from above (to prevent blurring of the plate during exposure by the stronger light on the surface). With this object I use three different contrivances: (1) A light wooden frame, six feet by four, over which is stretched a sheet of dark-colored canvas; (2) a large golf umbrella; and (3) a special apparatus on the principle of a sea telescope." The last-named of these three devices (shown in the illustration) is used when the surface of the water is ruffled. "It consists of a box three feet long and one foot square, fitted with a $\frac{1}{4}$ -plate reflex camera. The camera slides up and down inside the tube, and can be fixed at any point." One very striking photograph obtained by this method shows how a plaice (or flounder) makes itself safely inconspicuous in the mud at the bottom.

But more startling and enlightening photographs of aquatic life obtained by Dr. Ward are those for which he had to go elsewhere than his little observation pond. These, which were also obtained by means of subaqueous photography, have been published since the appearance of "Marvels of Fish Life." Three sets of these marvelous studies of nature are here reproduced from *L'Illustration*. They are studies respectively of an otter, a gull and a penguin. First comes the otter, as any terrified fish might see him, the air bubbles streaming away in his wake, as he noses about among the rocks, seeking what he may devour. There can be no question about the wickedly predatory expression of that head and neck. Next, he is seen in rapid pursuit of his quarry; and the camera informs us that he uses only his two hind legs in swimming. Lastly, he is shown nearing the surface (seen from below, of course) after a successful raid, with a fish in his mouth to be enjoyed at leisure after landing. The gull is shown in one picture much as men are accustomed to see him, borne on the rippling waves, and busy wondering where the best fish may be had with the least trouble: the next picture shows him as probably no human being ever saw a gull; he has just pierced the surface, and the agonized little fish on the right of the picture is swimming for dear life by the shortest way to the bottom. The penguin in the two photographs reproduced here, shows of how little use legs are to his kind: he walks very little on shore and uses only his wings for swimming. This also explains the mystery of the penguin's wings, with which he never flies.

Subaqueous photographs of vertebrates are not all the illustrations of Dr. Ward's "Marvels." There are numerous beautiful illustrations of molluscs and tiny crustacea. Some of the photographs of fish larvae in various stages of development are fine examples of aquatic micro-photography, and the author gives an illustration of a micro-photographic apparatus of his own contrivance, by means of which "it is possible single-handed to take photographs of living objects in a vertical or horizontal position by daylight or by artificial illumination." This apparatus, which photographs up to a magnification of 2,700, can be used by any photographer for an object which has first been posed on the stage by an expert biologist. The photographer watches, by means of a mirror, the changing positions of, say, the young fish in the cell, and makes the exposure at the opportune moment.

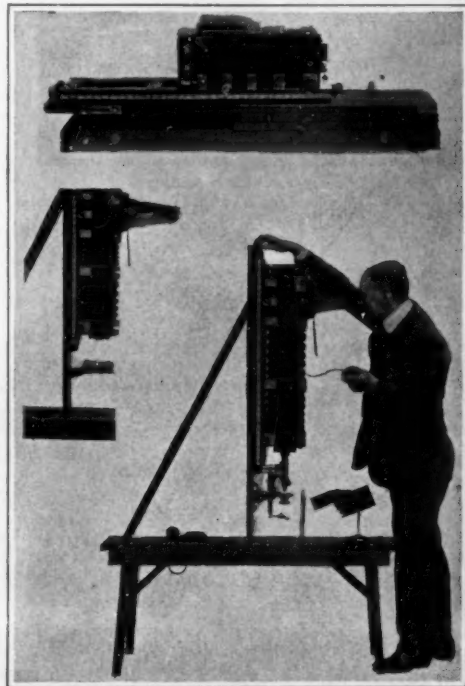
A drawing of two observation chambers for submarine life, reproduced here from *L'Illustration*, shows the latest attraction provided by a Honolulu hotel for visitors interested in the wonders of Pacific nature. The visitors will descend by a flight of stairs into one or other of these novel showrooms and watch the movements of such Hawaiian fauna as may choose to disport themselves for their amusement and instruction in the immediately adjacent waters.

New Berlin Electric Traction System

THE recent decision of the Government regarding the electrification of the whole suburban traction system of Berlin is an interesting one, and is in line with similar plans made for London, Paris, and other large cities. The present critical situation of Berlin transport led to the adoption of the new measure by which the suburban lines will be modernized in the period before 1916. A remarkable growth of population, as M. G. Richard states, is seen in the case of



Illustration.
Otter exploring for fish. As seen under water.



Dr. Ward's apparatus for vertical or horizontal micro-photography of live objects.

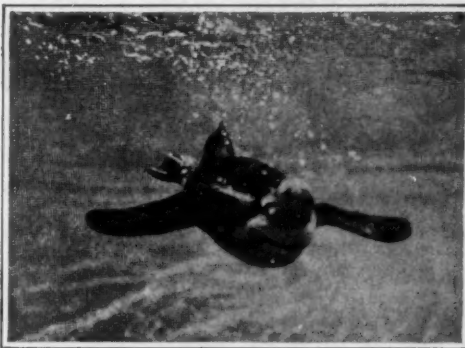


Illustration.
Penguin swimming under water.



Illustration.
Penguin coming to the surface—head and neck already above water.

Berlin. From 1895 to 1900, or the last census, that is in fourteen years, the population increased from 2,017,900 to 2,898,000. For the suburbs the increase is from 382,000 to 807,000, so that the population of Berlin and its suburbs reached 3,705,000 in 1900. As to the traffic on the Metropolitan, this was 75,000 in 1895 and 157,000 in 1900, and the suburban traffic shows 41 and 137 millions, respectively. On Sundays the traffic to the suburbs is as high as 341,000 to 794,000. After failing to secure a solution by the use of steam, it was decided to adopt electric traction on the whole of the lines. Then came the question of electric locomotives vs. motor cars, and it was found best to use locomotives, as these have some advantages. Each one replaces several motor cars, and very heavy trains can be drawn by coupling several locomotives together. Because the power machinery is larger the upkeep is less difficult, and the parts are easier of access. Besides, the yield in power is higher in the case of the locomotive. The motors are well suspended by springs, and the passengers are less subjected to shocks than with motor cars. One point is that a great part of the old passenger cars can still be used. For heavy traffic hours, 13-car trains are used and two locomotives take the trains, one in front and one at the rear. Such locomotives work on single-phase alternating current with 15,000 volts on a trolley wire such as is in use in the suburbs of Hamburg and on the Dessau-Bitterfeld line. Current will be furnished by two 150,000 horse-power electric plants, one to be erected at 80 miles from Berlin, near the Bitterfeld coal mines, and from here the current will come over a 60,000-volt power line, using for this purpose six pairs of underground cables. The second electric plant will be at Berlin. The cost of the stations and cables is figured at \$22,000,000, and these plants will be erected by a company with which a 30 years' contract will be made, as the Prussian Government considers that it is preferable not to have the State itself engaged in operating electric plants. Counting the central stations and substations along the roads, the overhead trolley wires, feeders, as well as the rolling stock electrically equipped, including 557 locomotives, 600 new cars, and 29 cars for repairs or upkeep, the total cost is estimated at \$32,000,000, and it is proposed to complete the whole of this great enterprise in four and one half years.

England's Greatest Rainstorm

ON August 26th and 27th, 1912, a serious disaster overtook the fine farming lands of East Anglia (the counties of Norfolk and Suffolk, in England), in the shape of a fall of rain that was without precedent in the British Isles. The catastrophe to agricultural interests was aggravated by the fact that harvesting had been delayed by inclement weather earlier in the month; the deluge carried away the grain that had been cut but not brought in, as well as destroying what remained uncut. Forty-two bridges were carried away by the flooded rivers, and an immense amount of other damage was done.

Although the spectacular features of this storm were recorded in the daily papers at the time, it has required some months for the collection of exact statistics of the rainfall. These have now been gathered, tabulated and charted by Dr. H. B. Mill, director of the British Rainfall Organization, who announces that the greatest long-continued widespread rain previously recorded in any part of the British Isles produced only half the volume of the East Anglian fall. In fact, only two instances could be found—July, 1875, and November, 1878—in which the rainfall of a whole month exceeded that of the 24 hours during which the recent storm continued.

While for scientific purposes rainfall is always reported in inches, to the layman such measurements are decidedly less impressive than statements as to the actual volume or weight of the rain. It may, therefore, be interesting to record that during the brief storm in question 150,242 million gallons of water fell in the county of Norfolk alone, the weight of which was 670,720,000 tons. This is more than twice as much water as is contained in Windermere, the largest of the English lakes.

An interesting local industry affected by the storm was canary raising, which is extensively carried on at Norwich. The birds are raised for the most part by workingmen, who keep the cages in sheds in their gardens. These were the first to be flooded, and as the highest concern was the saving of human life, no attempt could be made to move the cages. It is said that at least one particular strain of Norwich canary has been wiped out.

A Novel Aeroplane Propeller.—Spencer Heath of Washington, D. C., has patented, No. 1,043,830, a propeller formed from a blank of sheet material which is folded longitudinally to produce a number of thicknesses to form reinforcements and give the necessary strength to the blades.

The Heavens in January, 1913

Is Venus a Dead or a Living World?

By Henry Norris Russell, Ph.D., Professor of Astronomy in Princeton University

ONE of the most interesting objects for the amateur observer at the beginning of this new year is the planet Venus, which is now well placed in the western sky, setting between 8:30 and 9 P. M. With the telescope she appears like the Moon about one day after her first quarter, and with a magnifying power of 100 looks almost exactly the size that the Moon does to the unaided eye. The novice at the telescope will hardly believe this, for the inexperienced eye in looking at an object in the circumscribed field of a telescope unconsciously focuses itself as if on a neighboring object, quite differently from the way in which it adjusts itself to view the Moon in the open sky, and this unconsciously affects our judgment of the apparent size of the planet, as seen in the telescope. If the Moon can be seen in the open sky with one eye, and Venus through the telescope with the other, the true relation of the two images is apparent.

Though Venus is one of the most satisfactory objects on a first telescopic view to a beginner, she is one of the most aggravating to an experienced observer, for her brilliant surface obstinately refuses to show any definite markings by which we might hope to find in what period her rotation took place, or what was the inclination of her axis. Faint, ill-defined, fugitive shadings have occasionally been noticed, but they cannot be recognized on later nights, and leave us no wiser on the matters which we might wish to know.

That the planet's rotation is slow is however proved by two lines of evidence. First, when she is nearest us, and, in particular, when she passes between us and the Sun, as in 1874 and 1882, her diameter can be measured with great precision, and it has been found that her surface is practically spherical. We know that the Earth's rotation causes it to bulge at the equator, so that the polar diameter is 26 miles shorter than the equatorial. An equally great oblateness of Venus would have been very clearly revealed by such measures as have been described; and if the amount had been even one third as great, it would have been capable of detection. But to get one third of the flattening in the case of the Earth the period of rotation would have to be increased from one day to nine. Conditions on Venus are in this respect very similar; and we can conclude that if the rotation period of Venus was much less than ten of our days, the flattening at her poles could hardly have escaped detection, unless, indeed, her axis was very highly inclined to the plane of her orbit, and at the time of transit we looked almost squarely down on one of her poles, which seems decidedly improbable.

Another searching test was made some years ago at the Lowell Observatory, when Dr. Lowell and Mr. Slipher attacked the problem with the aid of the spectroscope. If the spectrum of the planet is photographed in such a way that the light which forms one side of the strip of spectrum comes from one limb of the planet, and that on the opposite side from the other, and if the planet is in rotation, so that one limb is approaching us and the other receding, the lines in the spectrum will be shifted, in accordance with the well-known principle, to the violet on one side of the spectrum and to the red on the other, so that they run across it obliquely, and not at right angles. From measures of this slant the rate of motion of the planet's equator, and hence the period of rotation, may be computed.

This method was tested with very satisfactory results on Mars, Jupiter and Saturn, giving values for the rotation period very close to those already known to be correct. In more recent time it has given astronomy its first definite knowledge of the rotation period of Uranus. But when applied to Venus it gave negative results. The lines in the spectrum ran squarely across it, and the most careful measurements, made with all precautions, showed that if there was any tilt at all, and hence any rotation of Venus, the tilt must be excessively small, and the rotation very slow. Anything much faster than one turn per month could probably have been detected.

Here the matter rests at present so far as observa-

tional evidence goes. Dr. Lowell believes that, as in the case of Mercury, Venus keeps always the same side toward the Sun, rotating once in 225 days, the period of her orbital revolution. An alternative theory, equally consistent with the observations, has been proposed by an English meteorologist, Mr. Clayden. The surface of Venus is so white, and reflects so large a proportion of the sunlight which falls on it, that we are almost shut up to supposing that it is composed either of snow or clouds. As the Sun's heat would be twice as great on Venus as here, permanent snow all over the planet is out of the question; clouds remain as the only alternative. These may be, as Dr. Lowell thinks, clouds of dust stirred up by the violent winds which sweep over the planet's surface from its desert but eternally sunlit side to the cold, dark hemisphere of night, where the oceans of the planet—if ever it had any—are piled up in mountains of ice.

Mr. Clayden, on the other hand, assumes the clouds to be ordinary clouds of water vapor. If the planet rotated as fast as the Earth, these would presumably

in short, which might be perfectly fitted to be the abode of life such as exists on our own Earth. Between the two in our present knowledge the imagination may choose, tantalized perhaps by the thought that if the second hypothesis be true, the true surface of this world so much like our own is forever hidden from us by the cloudy veil that protects it from the heat of too neighboring a Sun.

The Heavens.

Our map shows what may be seen in the evening skies as these would appear to a man lying flat on his back and gazing at the whole vault of heaven at once.

Right overhead and southward to the horizon is the finest region of all the starry sky, stretching from Gemini, Taurus, and Auriga past the two Dog Stars and Orion into Argo, whose great star Canopus can be seen low in the south from all latitudes south of Virginia.

Eridanus, Cetus, and Pisces fill the dull southwestern sky. Aries, Perseus and Andromeda are in the northwest; Cassiopeia, Cepheus, Draco, and Ursa Minor in the north; Ursa Major in the northeast; and Leo and Hydra in the east.

The Planets.

Mercury is morning star this month, rising about 5:50 A. M. on the 1st, and being visible in the dawn, while later on he draws nearer to the Sun and is not observable.

Venus is a splendid evening star, as already described.

Mars is morning star in Scorpio and Sagittarius, rising early in the month at about the same time as Mercury, with whom he is in conjunction on the 9th, but remaining in sight after the latter vanishes from the morning sky.

Jupiter is also a morning star, rising about 6 A. M. in the middle of the month. On the 11th he is in conjunction with Mercury, and on the 13th with Mars. All three planets are then within a few degrees of one another, but not conveniently placed for observation.

Saturn is in Taurus and is well observable, coming to the meridian at 9 P. M. on the 1st and at 7 P. M. on the 31st.

Uranus is in conjunction with the Sun on the 23rd, and is invisible.

Neptune is in Gemini, and comes to opposition on the 14th. He may easily be found (with a telescope) by means of the map published last month.

The Moon is new at 5 A. M. on the 7th, in her first quarter at 11 A. M. on the 15th, full at 11 A. M. on the 22nd, and in her last quarter at 2 A. M. on the 29th.

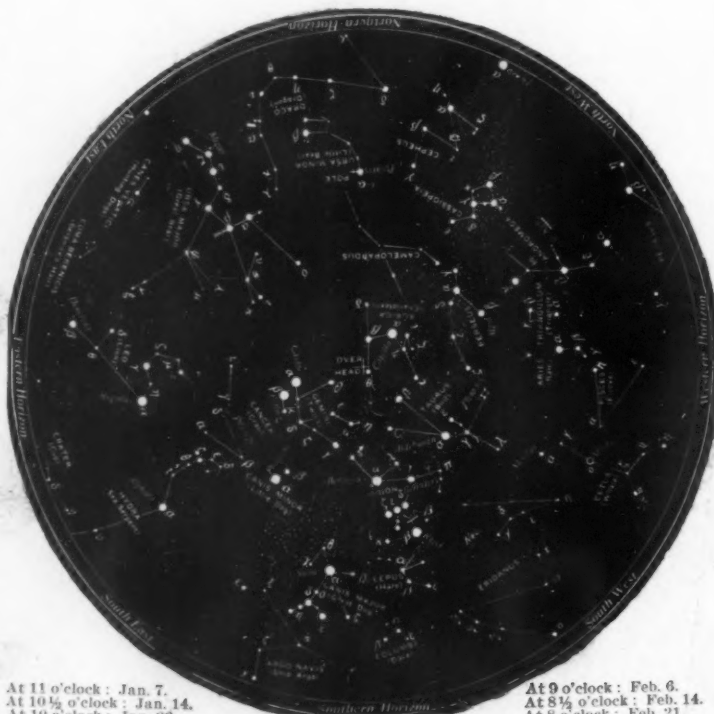
She is nearest the Earth on the 23rd, and farthest away on the 11th. As she moves around the skies she passes through conjunction with Mercury, Mars and Jupiter on the 5th, Uranus on the 8th, Venus on the morning of the 11th, Saturn on that of the 18th, and Neptune on the 21st—none of the observable conjunctions being close.

To Our Subscribers

WE are at the close of another year—the sixty-eighth of the SCIENTIFIC AMERICAN's life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.

The British Association for the Advancement of Science will hold its next meeting at Birmingham, beginning September 10th, 1913.



NIGHT SKY: JANUARY AND FEBRUARY.

arrange themselves, as on our own planet, in patches and masses, denser in some latitudes than others, but with clear spaces between. If the planet always turned the same side to the Sun, clouds of the sort we are now considering could hardly exist at all on its sunward side. But, according to Mr. Clayden, if the period of rotation was several weeks in length, the atmospheric circulation would depend directly on the planet's rotation, and it would be quite possible for the side toward the Sun to be permanently cloudy, with perhaps regions of broken cloud here and there, varying from time to time, which would explain the faint markings sometimes seen.

We have thus two pictures of conditions on our sister planet between which to choose, both of which are consistent with the known facts of science. One is of a dead world with one side a desert, hotter and more arid than any in Arabia or Arizona, under the blinding glare of never-ending sunshine twice as hot as ours and swept by dust-laden hurricanes, while the other side is swathed in endless night, and cold beyond the keenest frosts of our polar winters. The other shows us a world which may be as much like our own in surface as it undoubtedly is in size and mass, with an atmosphere and oceans, rotating far more slowly than the Earth, but yet so that the intervals of continuous light or darkness are not as long as in our own Arctic or Antarctic lands, with a sky covered always with clouds dense enough to reflect away into space the dazzling beams of the Sun, leaving below them perhaps no more light, and no excess of heat above what we ourselves are familiar with; a world,

Edward Charles Pickering

By Marcus Benjamin, Ph.D.

THIS year the American Association for the Advancement of Science will meet in Cleveland, Ohio, to which place it returns after an absence of twenty-four years. The presiding officer of the meeting will be Edward Charles Pickering, the most eminent of living astronomers in the United States.

Prof. Pickering was born in Boston, Mass., on July 19th, 1846. He is the son of Edward P. and Charlotte Hammond Pickering. His ancestry on his father's side goes back to John Pickering, who came from England and settled in Salem in 1642, and includes among other distinguished persons famous in the history of our country, Col. Timothy Pickering, who after service under Washington in the field became Postmaster General, then Secretary of War, and finally Secretary of State during the administrations of Washington and Adams.

Young Pickering was educated at the famous Boston Latin School, and then passed to the Lawrence Scientific School of Harvard, where he was graduated in 1865 with the degree of B.S., having taken the course in civil engineering.

His ability had been so evident during his undergraduate years that he was at once made an instructor in mathematics in the Lawrence School, but his stay was short; for in 1868 he was called to fill the Thayer chair of physics in the then recently organized Massachusetts Institute of Technology, where he remained for nine years. During this period he organized the first working laboratory in physics in the United States and the methods inaugurated by him have since been adopted elsewhere. In connection with his work he prepared the volume on "Physical Manipulation" (1874), a text-book that has received high commendation and is still universally esteemed.

In 1876, soon after the death of Prof. Joseph Winlock, he was called to the chair of Geodesy and Astronomy in Harvard with the directorship of the great observatory there, which place he has since held.

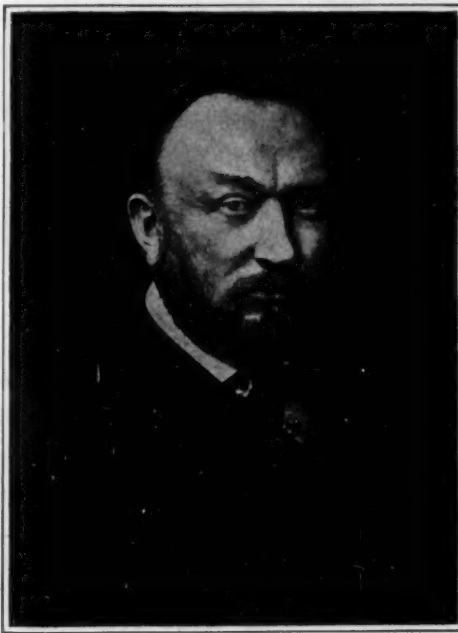
With his extraordinary zeal for investigation and at his disposal a splendid instrument of 24-inch aperture, the lens of which was ground by Clark, Prof. Pickering at once began those special studies that have gained for him and the Harvard Observatory so much renown. These studies have been largely devoted to examination of the light and spectra of the stars for the purpose of determining their brightness. For this object he devised a mechanical meridian photometer with which he has made over a million and a half measurements of the light of the stars. The details of this work were given in a catalogue entitled "Harvard Photometry," in which he gives the magnitude of over 4,000 stars, and in a later publication similar measurements of more than 21,000 stars are given. He measured Jupiter's satellites while they were undergoing eclipse from 1878 to 1891, as well as the satellites of Mars and other faint objects. Subsequent to the death of Henry Draper he began the application of photography to astronomy and in a memorial to his friend he undertook an investigation of the spectra of the stars by photography on a scale greater than ever before attempted, resulting in the publication of an elaborate memoir dedicated to the memory of his colleague.

In consequence of a fund of \$250,000 left by Uriah A. Boyden to the observatory for the special purpose of studying the stars at high altitudes, he established, in 1890, an observing station at Arequipa, Peru, and there his brother, William H. Pickering, observed the stars of the southern heavens, thus extending the work that had been begun in Cambridge, until photographic charts of the entire heavens from pole to pole have been made. These and other studies of the work accomplished under his direction have for the most part been published in the "Annals" of the Harvard Observatory of which nearly one hundred quarto volumes have been given to the world, and of these more than one half have been issued under his editorship since he became director.

His other scientific activities, and they have been many, included services as a member of the U. S. Nautical Almanac Expedition sent to Mount Pleasant, Iowa, to observe the total eclipse of the sun on August 7th, 1869, and he was also a member of the party sent by the U. S. Coast Survey for a similar purpose to Xeres, Spain, in December, 1870. The subjects of mountain surveying, the height and velocity of clouds have attracted his attention, and he did much toward the organization of the Appalachian Mountain Club of which he was the first president in 1877, and again served that club in a like capacity in 1882.

His many services to science have not

passed without recognition. He received the Henry Draper gold medal from the National Academy of Sciences in 1877. The Royal Astronomical Society of London gave him a gold medal in 1886 for his photographic researches, and again in 1901 for his studies on variable stars. He received the Rumford medals in 1891 and the Bruce medal from the Astronomical Society of the Pacific in 1908. His own Harvard in 1903, California in 1886, Michigan in 1887, Chicago in 1901, and Pennsylvania in 1906, have conferred the degree of LL.D. upon him, while Victoria gave him a Sc.D. in 1900 and Heidelberg in 1903 bestowed upon him the degree of Ph.D. The German Emperor conferred upon him in 1911 the order Pour le Merite with the rank of knight, thus indicating the high appreciation



Prof. Edward Charles Pickering.

President of the American Association for the Advancement of Science.

tion with which his work is regarded by the savants of Germany.

His elections to scientific academies have been numerous. In 1873 he was chosen to membership in the National Academy of Sciences, and he has long been a fellow of the American Academy of Arts and Sciences (vice-president in 1877) and a member of the American Philosophical Society since 1896 (vice-president in 1909). He also holds honorary or corresponding connections with the Royal Society of London, the Royal Astronomical Society and of the great academies of sciences in St. Petersburg, Berlin, and Rome, as well as of many other less well known.

He was elected to the American Association for the Advancement of Science at its Salem meeting in 1869 and was advanced to the grade of fellow in 1875. His affiliations have always been with the sections devoted to mathematics and astronomy, and physics. He was chosen to preside over the section on the physical sciences in 1877, and at that meeting presented an address on the Endowment of Research. No astronomer has been called to fill the high office of president of the American Association since 1893, when the late William Harkness held that important office. At the meeting held in Washington a year ago, when the claims of astronomers were considered, the candidate

who at once commanded the recognition of his colleagues by his distinction in his chosen science, was Prof. Pickering, who was then unanimously chosen to preside at the Cleveland meeting, which will be held during the present week.

A Demonstration of Forestry Erosion Processes

By Stephen Byrd

EXPERTS of the Government have been successful in the construction of a striking working model showing the processes of erosion on deforested slopes. It is for the use of pupils in public schools who are taking courses in nature study, elementary agriculture and physical geography.

The model, about seven feet square, consists of two hills sloping down into two valleys through which two streams wind in and out through farm land and lead into two lakes at the front of the landscape. Both hills are made of the same kind of soil, but one is covered thickly with twigs, young trees, or shrubs, to simulate a forest, underneath which is a heavy carpet of moss representing the layer of leaves and twigs which covers the ground in the real forest, while the other hill is bare of all vegetation.

By means of a suitable sprinkling device on the ends of a "T" about 1½ feet above the crests of the hills, water in the form of rain is made to fall with equal force upon the two hills. On the forested slope its fall is broken by the foliage and it drops gently upon the moss-covered surface of the ground. The moss and the soil beneath, which is kept soft and porous by the protective cover, quickly absorb the "rain" and allow it to seep out as clear water farther down the slope, thus forming a mountain stream which flows through a green and fertile valley into a clear lake at the lower end of the model.

On the other slope the "rain" beating down upon the unprotected and hardened surface washes deep gullies in the hillside, carries the soil into the turbid stream which drains the valley below, and thence into a muddy lake. The erosion on the slope loosens stones, which are carried down upon the valley farms; the silt deposited in the channel of the stream diverts the water, which opens up gullies through the dry land; the main stream is made shallower and wider and often overflows into the fields; island and silt bars rise in the stream; and deltas are built up in characteristic form at the entrance to the lake.

The erosion processes which work themselves out in the model, the wearing down of the hill, the silting up of the stream bed, the gradual shifting of the course of the stream, the formation of deltas and sand bars in the lake, and the gradual opening up of water-courses through them are all typical of the processes constantly going on in nature and show strikingly the close relationship between forests and surface formation. It is the same process of erosion on a larger scale which, after the destruction of our forests, causes the removal of the top soil from our slopes, cuts them up into gullies, and deposits sand and gravel upon the fertile alluvial soil of the bottom lands, in storage reservoirs, or in the channels of streams, where it impedes navigation and causes overflow.

While the model is not intended primarily to show more than the erosion processes, it can be used to show also that a forest-covered slope acts as a reservoir in impounding the water and allowing it to seep slowly into the streams, and, on the other hand, that water runs off the surface of a bare slope as soon as it falls, resulting in floods when the precipitation is heavy and in droughts during a dry season. If the sprinkler is stopped and all the water taken out of both of the stream and the lakes, the lake on the forest side will, within a few hours, receive a considerable amount of water as seepage from the wooded hillside, while the other lake will remain practically empty.

When the water is first turned on, that which comes from the forested hill will be slightly muddy, but will clear after running for a few minutes, and the mud will soon settle. Erosion will set in upon the deforested hill and the land below in a few hours.

In some of the models white sand and pebbles and small goldfish or turtles in the clear lake, have added a touch of realism and brought out the clearness of the water. Other ideas to add to the picturesqueness and instructiveness of the model have also been evolved, such as a road running through the fields, bridges across the streams, and a little farm house or barn appropriately placed. The bridge across the muddy stream is represented as damaged by floods, and the road on that side of the model muddy and deeply furrowed. In the construction of

(Concluded on page 200.)



Working model for demonstrating to pupils in public schools, the processes of erosion on deforested slopes.

Inventions New and Interesting

Simple Patent Law ; Patent Office News ; Notes on Trademarks

A New Aluminium Level

A LEVEL has recently been placed on the market made of aluminium, which for a metal level is light, as well as strong and durable. It will not warp, and with ordinary care will last a lifetime, not being affected by either dampness or heat.

It is doubly constructed; that is, it has two plumbs and two levels, so that no matter in what position it is picked up, it is always ready for use and can be used either end or edge up. The illustrations show it in use with the eye of the mechanic both above and below it. Plumbing can also be done with the eye above or below the spirit glasses.

There are two wires around each spirit glass, so that the position of the bulb can instantly be seen. The spirit glasses are securely set and cannot move or be jarred out of place. They are also guarded by heavy lenses set in the circular openings of the level frame to make the spirit glasses dust, dirt and water proof.

For the use of carpenters, millwrights, cement workers and plasterers the level is made in lengths of 3 feet 6 inches, 24 and 30 inches. Those designed for the use of machinists and others desiring shorter levels, are made 12 inches and 18 inches long.

A Combination Bevel Square

A SQUARE has been produced which combines a bevel square, divider and pencil compass, and measures ten inches over all when folded. The stock is formed with flanges on both sides, and the adjustable blade folds between the sides of the stock. In scribing angles from narrow flutes, or grooves, the operator can insert the flange of the stock in the groove and work from the face of the bevel. The square can be set with the pointed ends at any desired distance apart. Thus it is converted into a good divider. When used in the same form, with a pencil inserted in the holder at the outer end of the stock, it becomes an excellent pencil compass.

A Combination Pocket Rule

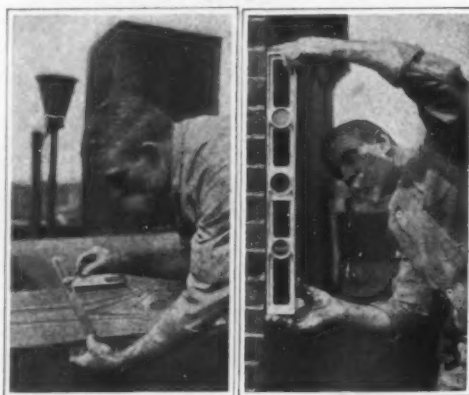
THE six-inch folding pocket rule, two views of which are given in the accompanying illustrations, is made of spring German silver and distinctly graduated. It can be used as a hook rule, caliper gage, protractor, triangle or try-square. The upper edge is graduated in thirty-seconds; the lower edge in sixteenths. The caliper blade is graduated in sixteenths on one side and thirty-seconds on the other. The protractor is divided to five degrees and the vernier reads to one half a degree. This rule can be set to any desired angle, and the center joint is so constructed that the rule remains firm wherever set. The protractor is divided into lines, each representing five degrees. The ten parts on the vernier correspond with the nine parts on the protractor. Consequently, each division on the vernier is smaller than each division on the protractor by one half degree. To read the distance the rule is opened and the number of lines on the protractor that have been moved from the zero point is first noted. Upon the vernier the number of divisions is then counted until one is found which coincides with one on the protractor, which will be the number of degrees or half degrees to be added to the distance read off on the protractor.

A Machine That Addresses Tags

A FEW years ago it was discovered in one of the large fertilizer companies in this country that during the busy shipping season of six weeks or more, it took every clerk in the office and everyone in the establishment, who could write with a pen and ink, six weeks or more to address shipping tags. By the time the shipping season was over, the work of everybody connected with the office force was so far behind that it took until the next busy shipping season to catch up. This led to the invention of the tag addressing machine. To-day, in that same establishment, the tag addressing machine, the first one ever produced, stands on the end of a long table in the basement. It is operated by a boy, who addresses all the tags required in the shipping department of the fertilizer company referred to. In spite of the fact that the business has increased wonderfully from what it was five years ago, when the tag addressing machine was installed, the boy has plenty of time to devote to other duties. At a test recently, the boy in one minute addressed two hundred and seventy-eight shipping tags, including setting up the name and address. In two seconds or thereabout the type wheels of the machine were returned to neutral and he was ready for another name and address.



Using the aluminium level horizontally.



Combination bevel square. Using the level vertically.



The combination pocket rule used as a caliper gage.



The vernier protractor of the combination pocket rule.



A machine that addresses two hundred and seventy-eight shipping tags in a minute.

The tags for use in the tag addressing machine are automatically fed up into and through the machine in a strip from the storage bin in the cabinet, the tags being separated by a cut across to within 3/16 inch on each end.

The business card is printed from an electropiate attached to and made part of the machine.

The consignee's name and address is printed by type wheels, being adjusted by means of levers. A dial is set for the number of tags required for shipment and is automatically cleared when the number indicated has been printed.

There are no loose types in this machine and no stencils or plates, the type wheels being governed by a name lever and an address lever. An automatic counting device on the machine absolutely controls the number of tags printed, locking and cutting off the tags when the number indicated on the dial are addressed.

The machine is built to take a Standard No. 5 tag or record card as well as a very thin paster, which can be attached to cartons or boxes by means of paste or fasteners as the requirements of the shipper may warrant.

The machine prints the name and address of the consignee and such other information as may be desired.

The automatic counting device does away entirely with the possibility of loss through undershipments or overshipments, as the machine will produce exactly the number of addressed tags indicated in each instance.

Prize Offered for a Test to Detect Flaws in Autogenous Welds

THERE is at the present day one obstacle in the way of a more general adoption of autogenous welding of metal constructions which in use are subjected to considerable strains, and the rupture of which would endanger human life and property. This obstacle resides in the fact that no process is known by which the quality of the finished weld can be tested. Experiments have shown that the first condition to be fulfilled if the weld is to be sound, is that inclusions, large or small, must be avoided, and that the material does not become overheated in the process of welding.

The Central Bureau for Acetylene and Autogenous Metal Working in Nürnberg, with a view to perfecting the autogenous welding processes, has decided to offer prizes of an aggregate of 1,500 marks (\$375) for the successful treatment of the problem stated below. The Carbidhandels-gesellschaft m. b. H. has generously furnished the requisite funds.

Problem: How can slag inclusions and unsound places, as well as flaws due to overheating, be detected in an autogenous weld, without injuring the weld in the process of testing?

In adjudicating the prize, special merit will be assigned to processes which make use of simple, readily transportable apparatus. It should also be noted that prizes may also be awarded to the originators of such processes as furnish a means of judging the quality of a weld satisfactorily in a majority of cases, without necessarily representing a complete solution of the problem.

The thesis must be submitted in writing, and must be identified by a motto, the name of the competitor to be filed in a sealed envelope, together with the motto appearing on the thesis. Entries must be completed on or before July 1st, 1913, and sent to the address appearing at the end of this announcement.

The jury will consist of the following gentlemen:

Geh. Regierungsrat Prof. Dr. Ing. Dr. F. Wüst, president of the Iron Institute of Aachen.

Prof. Dr. Ing. G. Schlesinger, president of the Mechanical Engineering Experiment Station at the Technical University of Charlottenburg.

Prof. R. Baumann, director of the Bureau for Testing Materials of the Technical University of Stuttgart. Ingenieur Hermann Richter, professor at the Technical Professional Schools of Hamburg.

Karl Schröder, chief engineer of the Railway Supplies Company of Upper Silesia.

One representative of the undersigned Büro.

The prizes are awarded by the jury.

The first prize will be 1,000 marks (\$250); the second, 500 marks (\$125).

The thesis for which the prize is awarded will be published without compensation.

(Signed) Zentralbüro für Acetylen und Autogene Metallbearbeitung, Nürnberg, Gugelstr. 54.

Invention Versus Aggregation

IN a recent case in the United States District Court, Southern District of New York, Mr. Justice Mayer, District Judge, in his decision, the invention being a water heater, pointed out that prior to the invention of the patent in suit, the art of automatic instantaneous water heating had developed along two main lines: (a) the "straight water valve" heater and (b) the "straight thermostatic" heater. He proceeded to point out the defects in both (a) and (b) forms of heater, and that while one was not a commercial success, the success of the other was limited to natural gas territory, because of the large cost of operation in artificial gas territory, and said:

"The problem to be solved and here claimed to have been solved was to produce an instantaneous, automatic water heater which would (1) be safe; (2) be economical; (3) heat the water to a desired predetermined temperature, and (4) proportion gas consumed to amount of hot water drawn, even in localities where gas and water main pressures fluctuate.

"This was an interesting problem having to do with an important and useful art which has much conduced to health and comfort.

"Ruud was an experienced man who had already made contributions to the art, and he was able, therefore, to approach the consideration of this problem in a practical way. He was not searching for a theory, but for an operative structure, and there can be no doubt that he produced an efficient and highly useful article in the 'T. V.' heater, as it is called.

"From the outset, this T. V. heater became a commercial success, so much so that the Monarch Company, a competitor, adopted the Ruud invention at a time when the patent application was pending and when letters had not yet been issued."

He then asks:

"Was there inventive genius behind this production or was it obvious to the man skilled in the art and a mere aggregation of old elements and not a combination attaining a new result?"

The object of the invention set forth in the patent in suit is stated in the patent itself to be:

"To provide effective and reliable means whereby waste of gas, during periods in which it is not desired to heat water, may be prevented, and liability to damage to the heating appliance or its connections, by the application of heat in the absence of a proper supply of water, or by the excessive application of heat when water is not drawn off from the heater, due to the sticking of the water valve mechanism, may be effectually obviated." (Page 1, lines 21 et seq.)

To accomplish these objects, Ruud introduced into the gas service conduit a gas supply valve and a gas regulating valve, by which two valves the supply of gas to the main burners is controlled and regulated.

"The main or water actuated gas valve is always thrown wide open, and is of sufficient size to admit enough gas to heat the water to the desired temperature at the highest water main pressure, and the lowest gas main pressure. With the high water main pressure a larger amount of water would flow through the heater, per unit of time, than with the low water main pressure, and if the supply of gas were constant the result would be that the water would be heated to a higher degree at a low water main pressure than at a high water main pressure.

"When the water in the heater reaches the degree of temperature to which the thermostat is adjusted, the thermostat immediately begins to actuate the thermostatic valve to reduce the size of the opening controlled thereby, and hence to reduce the amount of gas which flows to the burner. Should the gas pressure be high, more gas is supplied than is needed to heat the water to the desired temperature, and the thermostat operates to cut down the amount of gas until just enough is supplied to heat the water flowing through the conduit to the temperature desired. Should the pressure in the gas main fall, the temperature of the water would fall, and this would act to open the thermostatic valve wider so as still to permit enough gas to flow to the burners to heat the water to the desired temperature.

"Thus the water is heated to the desired temperature, whether a large or small amount of water within the capacity of the heater is being drawn, and the supply of gas to the burners is regulated to suit the amount of water heated, and this entirely independent of what may be the water main or gas main pressure at the instant of time when water is being drawn; and if no water is being drawn the flow of gas to the burners is entirely

cut off by the water actuated or main gas valve.

"It is old in the art to employ the movements of a part actuated by the flow of the water through the heater to control the flow of gas to the burners of the heater; and it was also old to employ the movements of a heat actuated element to control the flow of gas to the burners. These old elements had been separately used in heaters to control the flow of fuel to the burners, but Ruud, for the first time (it is claimed), combined the two elements in a single heater.

"I am satisfied on the evidence, that this combination produced a result which was not an aggregation of old elements, each merely performing an old and well known function and not bringing about a new result. If I am right in concluding that the new result, insisted upon by complainant, was accomplished by the combination of these old elements, then it seems to me that the case is one of invention.

"Of course, it is very easy at this date, to see how it was done; but this is an active art, attractive financially and constantly inviting improvement, and if invention was not involved it seems strange that no one had disclosed, prior to this time, any structure which represented what is embodied in the Ruud or T. V. heater.

"In his ingenious argument that certain of these patents accomplished by a short arm what Ruud accomplished by a long arm, the learned counsel for defendant failed to make clear how what was obvious (as he urged) so successfully escaped the attention of these many inventors whose minds were moving along in the same general direction."

Notes for Inventors

A Novel Trajectory Regulator for Projectiles.—Cleveland Davis, U. S. Navy, has patented, No. 1,043,074, a trajectory regulator in which there is combined with the projectile, plates which are mounted therein and move radially through centrifugal force to regulate the trajectory, and electric controlling means are provided which govern the extent of the outward movement of the plates.

A Power-operated Coupon Cutter.—A power-operated cutter to clip coupons is shown in the patent, No. 1,042,436, to Garret A. Hobart of Paterson, N. J. It is an electrically operated machine supplied with a knife-carrier pivotally supported at one end with a knife at its other end and an oscillating lever which is operatively connected with the knife-carrier and is operated through a suitable plunger by a solenoid.

"Sandwich Paper," a New Paper Product.—A French paper, devoted to paper manufactures, tells of a new paper product said to have been invented in Germany. It consists of two thin sheets of paper pulp between which is arranged a sheet of cotton or similar cloth with which the pulp layers are so thoroughly incorporated as to form practically an integral and compact sheet. It has been aptly called a sandwich paper and is adapted to a variety of uses.

A Sliding Pad for Baseball Players.—Frederick C. Clarke of Winfield, Kan., assignor to A. G. Spalding & Bros., Jersey City, has patented, No. 1,044,094, a sliding pad which is detachably secured to a garment and extends around the greater portion thereof. The pad is generally rectangular in outline and a loose lining is secured only at its edges to the pad, the pad being especially designed for use in sliding to bases.

Mixing Oil and Gasoline.—We are told that the fishermen off the coast of Maine, using motor boats, feed the lubricating oil to the cylinder with the charges of gasoline and dispense entirely with the lubricating cups on the cylinders. In this way they avoid the care of the cup and are sure the oil is feeding so long as the gasoline supply is maintained. Ordinarily, about one pint of oil is mixed with five gallons of gasoline. The only objection suggested to the practice is that the carburetor becomes foul and must be cleaned oftener than otherwise; but this is more than balanced by the freedom from worry about the feeding of the oil.

A Stocking With Two Feet.—With a woman's appreciation of economy, Emma C. Parsons of Somerville, Mass., shows in a patent, No. 1,044,567, a stocking which has a leg portion with a foot portion at each end. In describing the stocking, it is said

to have a foot portion at one end of the leg and having at the opposite end of the leg and on the forward side thereof a fullness adapted to receive the knee of the wearer with an extension on the opposite side, the fullness and extension constituting the heel and toe of a reserve foot portion, it being the intention to wear out one foot portion and then the other, so that the leg of the stocking will do double service.

The End of Human Improvement.—In his report of the operations of the Patent Office during the year 1843, Henry L. Ellsworth, the then Commissioner of Patents, called attention to the whole number of patents issued by the United States up to January, 1844, as being thirteen thousand five hundred and twenty-three, and to five hundred and thirty-one of these patents having been granted in 1843, being an increase of twenty-four over the previous year. Then, apparently appalled by the great development and perfection of all the arts, the honorable Commissioner suggests the completion of invention at some early day in the following words embodied in his official report: "The advancement of the arts, from year to year, taxes our credulity and seems to presage the arrival of that period when human improvement must end."

Safeguarding the Operator.—In connection with a punch press or similar machine having a dangerous part, the operation of which is periodic, Frank C. Spencer of Chicago, Ill., provides in a patent, No. 1,043,876, a protective means which is actuated automatically in accordance with the periodic operation of the dangerous part and includes a gate which moves from one side of the operator's arms and transversely thereto into position in front of the dangerous part so that the operator's hands will be pushed away from the dangerous part as the gate moves into operative position.

A Life-saving Garment for Aviators.—The garment shown in patent, No. 1,042,327, to Joseph J. Costanzo of Alexandria, Egypt, is made with a number of concentric inflatable members adapted to be positioned around the body and collectively form a covering for the body, each of the members comprising a plurality of inflatable chambers and means are provided for holding the chambers in each member together.

Some Adjudicated Patents.—Among the adjudicated patents reported in recent issues of the *Patent Office Official Gazette*, are The Loesser & Loesser patent, No. 573,672, for a diamond polishing "dope," which was held invalid in *American Patent Diamond Dop Company v. Wood*; the Fessenden patent, No. 706,736, for apparatus for wireless telegraphy which was held not infringed in *United Wireless Telegraph Company v. National Electric Signalling Company*; the Parsons' patent, No. 723,299, for an armor for pneumatic tires which was held valid and infringed in *Parsons Non Skid Company v. Atlas Chain Company* and the Wood patent, No. 839,356, for a process of dividing diamonds which was held invalid in *Wood v. Kahn*.

Legal Notes

An Adjudicated Patent.—In the case of the Gilbert Manufacturing Company v. Post & Lester Company, 197 Fed. Rep., 56, the Bowers' patent, No. 872,892, for a spare tire holder for automobiles was held void for lack of invention.

Revision of Patent Law.—It is reported that the chairman of the House Committee on Patents, Mr. Oldfield, intends to demand action upon his recodification bill which was introduced during the latter portion of the last Congressional session and that he has called a meeting of his committee to take under consideration the steps necessary to secure the legislation he desires. It is probable that a unanimous report will support the recommendations of the committee. An object of Mr. Oldfield's bill is to secure the prohibition of price fixing by the patentees of the patented products and also to prevent the control of the supplies used in connection with the apparatus covered by the patents.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT CLASP.—M. KRISCHER, 14 Lewis St., New York, N. Y. This clasp includes a loop and a tab carrying a button, and the object of the inventor is to provide an improved means for securing the tab and to combine the tab with the buckle from which the loop and the tab are suspended in a novel manner. The clasp is more especially intended for use as a stocking supporter.

GARMENT POCKET.—T. J. CAHILL, Hotel Maywood, Corning, Cal. This improvement is in pockets for men's outer garments, and has particular reference to the construction of a pocket whereby foreign matter such as dust, water or the like may pass through the bottom thereof and escape, without destroying the usual functions of the pockets.

HOSE SUPPORTER.—NORMA F. SCHAFER, 47 Brevoort Place, Brooklyn, N. Y. This invention prevents tearing or ripping of the hose and allows of perfect freedom of limbs, especially at the knees. Use is made of a band having converging members, the terminals of which are provided with means for connection with the upper edge of the hose on opposite sides thereof, and supporting straps for the said band and connected therewith at the outer terminals and at the joint of the converging band members.

Of Interest to Farmers.

CULTIVATOR.—R. H. PURNELL, Rosedale, Miss. This invention provides a main draft beam with two attachments, one a supplemental pivoted beam carrying a scraper or other cultivating device to swing laterally, to vary the lateral angle of the scraper; the other is a runner and gage arranged in rear of the supplemental beam and adapted for vertical adjustment, to vary the depth at which the scraper or other tool shall enter the soil.

MILK PAIL COVER.—W. A. METZGER, care of W. H. Montgomery, Red Hook, N. Y. This invention provides a structure to thoroughly cover the pail, but prevent any foreign or extraneous matter from entering during milking. It provides a cover for use during milking which will permit the milk freely to flow into the pail, but which will prevent or minimize the splashing of milk.

CORN PLANTER.—M. H. W., 1422 Franklin Ave., Lexington, Mo. This invention provides a driving mechanism for the dropper operable by the carrying wheels of the planter, which may be regulated as to the initial operation to place the seeds in parallel arrangement in a planted field; and provides a driving mechanism which is simple, and at all times under control.

DISK PLOW AND BEAM THEREFOR.—A. N. MCKELLIPS, R. F. D. No. 2, Billings, Mont. In the present patent the invention has reference to disk plows, and it has for its purpose the provision of one with a beam having a curved end, and disposed around and secured to a bearing, in which is journaled a stud secured to and projecting from a disk.

Of General Interest.

TOILET POWDER DISPENSER.—E. OLDENBUSCH, care of Kronheimer & Oldenbusch, 366 Butler St., Brooklyn, N. Y. A movable closure is automatically operated by pressure to release a portion of the contents of the container, and is automatically closed after pressure thereon is relieved, and combines with such automatic closure, means whereby its opening movement is limited so that accidental displacement and disconnection between the closure and the container is prevented.

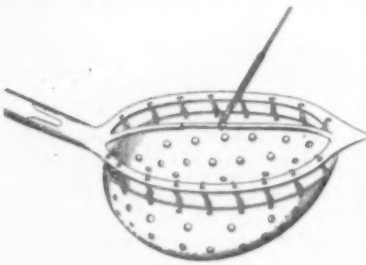
PROJECTILE AND METHOD OF FIRING THE SAME.—R. POMPELLI, Villino Arnaldi, Tivoli, Italy. The invention has for its object to do away with the cumbersome and heavy gun barrel by utilizing the combined action of the high explosives, and of the resistance or inertia of the air. In high mountains the invention enables artillery to reach places not approachable up till now; it avoids many difficulties of transporting heavy guns and allows of the locality being quickly abandoned and moving the heavy pieces and gun carriages. Still more important is the use of the method on board of dirigible airships in which it is impracticable to carry pieces of ordnance. It is not only useful for fighting against other dirigible airships, viz., for firing projectiles in horizontal directions, but also downward. The method can be also used for throwing safety ropes to ships and in other similar cases.

RIFLE WIPE ROD.—J. HURST, care of C. L. Odell, 213½ 19th St., Bessemer, Ala. The wipe-rod or wipe-stick proper is so attached to a tubular handle as to adapt it to rotate, and also to be quickly clamped in the handle when required. A series of wipe-rods may be employed with one and the same handle, and each of them will have, in practice, a terminal portion. Thus it will only be necessary to provide plugs which have a bore that receives the particular wipe-stick that may be inserted in the handle.

ARTIFICIAL LIMB.—U. HOKK, Cornwall,

Pa. This invention provides a device of the peg leg type arranged for permitting the peg to stand in alignment with the axis of the stump socket, or at an angle thereto, wherein means is provided for locking the parts in alignment, capable of being easily locked or released through the clothing which will hold the parts in rigid alignment when in locked position.

BUCKET—C. H. GIBSON and T. CREEDE, Box 833 Wenatchee, Wash. This invention is especially adapted for use with the dredging apparatus in these inventors co-pending application, serial No. 677,697. It is for prospectors use, the production cost is low and is one that is not easily deranged, thereby providing for continued and efficient use in places where very extensive repairs are not possible. It is primarily designed to run along the gravel beds or sandy bottoms of streams with the pointed end foremost, the actual movement of the bucket being provided through suitable means on which a certain cable or chain or rope is wound, the guiding of the bucket being



DREDGING BUCKET.

attended to by an operator through the medium of the handle seen in the illustration. This form of bucket is in use on their dredger now working in some of the most inaccessible places in Alaska and the Northwest.

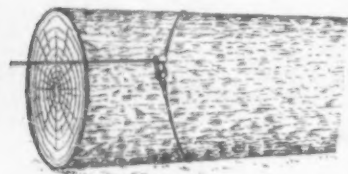
AN ADJUSTABLE SANITARY HAIR AND TOOTH BRUSH—A. L. HOLTMAN, 192 Central Ave., East Orange, N. J. This inventor provides a hair or tooth brush, as shown in the illustration, supplied with a removable bristle holder to permit of replacing the same when the bristles are worn out and thus allow the use of a single expensive brush handle with a number of bristle holders for a very long period at a nominal price. For this



ADJUSTABLE TOOTH BRUSH.

purpose, use is made of a handle having a seat for the reception of a bristle holder, and means for removably securing the bristle holder on the seat. It is adapted to be made in any shape especially for tooth brushes and hair brushes. The back of the bristles are set in rubber, which insures against any bristles falling out or any soginess of the brush. The handle of this highly sanitary brush is preferably made of gold, silver or celluloid, and there are no screws, hinges or springs to help getting the device out of order.

SAFETY LOGGING HOOK—E. J. LARSON, Box 337 Marshfield, Ore. This invention pertains to hoisting block and tackle, and has particular reference to an improved hook adapted especially for use in connection with a draft cable, such as is used for instance in logging camps or like places where heavy ob-



SAFETY LOGGING HOOK.

jects are being drawn by distant power. The invention specifically covers certain details of construction embodying elements of cheapness, maximum strength and highest efficiency and safety during operation. The cable is passed around a log as shown in the engraving, where it is represented in operative position.

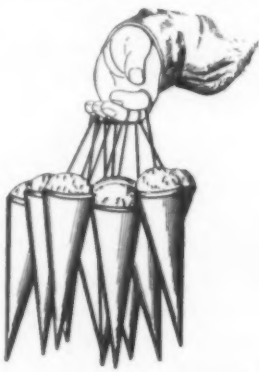
COLLAPSIBLE TUBE—C. H. STEUART, Newark, N. Y. The intention here is to provide a tube having an outlet neck, and a closure therefor, so formed and arranged that the closure will have a tight fit at all times in the outlet orifice of the neck, and will not become loosened by repeated insertion and removal.

PIPE COUPLING—E. L. BLOOD, Mulberry, Fla. This invention comprehends more particularly a flexible coupling especially adapted for use on the suction and discharge sides of pumping devices in order to relieve the pipe

line of vibration. It is also adapted for use as a flexible connection in any hydraulic line, pumping water or water and other substances.

TURPENTINE CUP—W. O. DALY and L. LERIO, care of Lerio Turpentine Cup Co., Mobile, Ala. The inventors provide a construction whereby the cup can be easily applied, be securely held in position when applied and can be easily removed and reapplied when desired. To this end they provide in connection with the cup proper bearing devices above and below the cup and having interlocked engagement with the cup so that the cup when applied in connection with these bearings will be securely clamped in position.

HOLDER FOR ICE CREAM CONES—J. RENNER, P. O. Box 238, Rockwell City, Iowa. The aim in this invention is to provide a hold-



HOLDER FOR ICE CREAM CONES.

er for ice cream cones, which may be manufactured at little expense, and which makes it possible for one person to carry and distribute a great number of ice cream cones at one time, without it being necessary for him to touch the ice cream cones or to soil them. In this way the cream cones may be carried about by any person without danger of their becoming soiled or dirty and also of not being so liable to melt as quickly as by other methods of handling. The engraving shows how a large number of the cones are carried. This invention is for sale outright, or may be manufactured on a royalty basis.

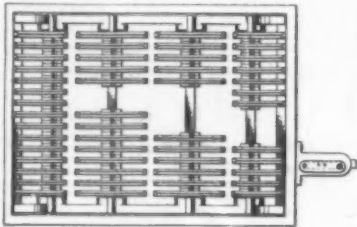
DIAMOND HOLDER—F. W. BAUSCHER, 477 Canal St., N. Y., N. Y. This device holds diamonds and other gems when they are to be worked and polished and it comprises a base so mounted that it can be moved into any position for the operator, and it is provided with means for holding the gem securely in place until the operation of polishing is finished.

Hardware and Tools.

HAND STAMP—H. NEUMANN and A. DORNER, 552 W. 126th St., Manhattan, N. Y., N. Y. The aim of this invention is to provide a stamping device more especially designed for stamping hams and other meats or other articles, and arranged to permit the operator to conveniently handle the device so as to stamp a large number of articles in a comparatively short time.

Heating and Lighting.

FURNACE GRATE—M. E. HANSELL, P. O. Box 3, Anamosa, Iowa. This invention is intended more particularly for embodiment in the grates of steam boiler furnaces, and it relates to that type of grate in which removable grate sections are provided. This invention improves grates in various particulars to the end that the grate sections, the grate bars, and the rest bars on which the grate



FURNACE GRATE.

bars are removably supported, may be conveniently removed and renewed when desired; and it minimizes the possibility of clinkers causing the breakage of grate sections in the rocking of grate elements. The engraving shows a plan view with some of the grate sections removed.

Household Utilities.

ATTACHMENT FOR BEDS—J. G. LAYCOCK, Box 107, Russellville, Ohio. This invention has reference to attachments for beds, and more particularly it is directed to an improved construction especially adapted for use in hospitals or for the use of invalids generally whereby such persons may assume a sitting posture when so desired.

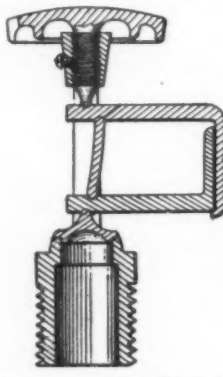
COMBINED CURTAIN ROD AND SHADE FIXTURE—C. W. SUMNER, 819 7th St., St. Petersburg, Fla. This improvement provides a device for supporting a curtain and a blind

roller, which consists of few parts, is capable of being adjusted to fit any casement, may be adjusted vertically on the casement and has means adjustable on the same for supporting the blind roller.

VALVE—A. B. UTLEY, 942 Ross St., Springfield, Mo. This improvement has for its purpose the provision of a simple valve for use with flushing tanks for controlling the tanks for controlling the flow of water to the tank, wherein means is provided for quickly closing the valve at the proper time, regardless of the water pressure.

Machines and Mechanical Devices.

AUTOMATIC SPRINKLER VALVE—L. A. GRIMES, 205 Windsor Place, Brooklyn, N. Y. The invention relates to a valve where the



AUTOMATIC SPRINKLER VALVE.

water outlet is opened when subjected to influence of abnormal temperature. The operation depends upon the melting of some fusible metal, but in present devices the separation of metals held by the fusible solder, takes place either in a V movement, a sliding movement, or their combination. It is an object of this invention to eliminate the possibility of cold flow, by constructing the two parts so as to separate bodily one from the other and thereby utilizes the whole area of adhesion afforded by the soft solder. The engraving herewith shows a vertical transverse sectional view of the invention.

RECTIFYING DEVICE—J. H. W. KNOOP, care of Phila. Inquirer, 1109 Market St., 6th floor, Phila., Pa. This improvement relates to rules in tabular and similar matters produced by line or type producing machines, and its object is to provide a new rectifying device to enable an operator to bring into perfect alignment the rules of such tabular matter.

Prime Movers and Their Accessories.

STEAM ENGINE—M. A. GREEN, 642 Real Estate Trust Bldg., Philadelphia, Pa. The purpose here is the provision of simple, economical and easily operated means for varying the clearance of each end of the cylinder in order to increase or diminish the compression and without affecting the total length of the cylinder or total length of the piston.

Designs.

DESIGN FOR A HANDLE OF SCISSORS-BLADES—W. M. ROWES, care of Clayton Bros., 127 Duane St., New York, N. Y. In this case the design of a handle of scissors blades shows a result pleasing in form with an ornamental feature on the inner edge of marked originality.

DESIGN FOR A DOLL—EDITH M. MINER, Colville, Wash. In this design for a doll a small girl stands with arms outstretched and is clothed in a dress whose ornamental features comprise squares dotted over the whole, these squares being spread also over the hair, face and feet, and producing an extremely original and effective article.

NOTE—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Janeway's Insufflation Apparatus

(Concluded from page 548.)

up the trachea and out through the larynx and mouth in a continuous stream shall have free escape. Later it was found of advantage to interrupt the stream from three to six times a minute, to allow the lung to collapse for a moment at times, and thus to get rid of the small quantities of carbon dioxide (the gas normally excreted from the body by exhalation) which are apt to remain in the pulmonary alveoli.

We may no longer pursue this fairy tale of science, in which appear such illustrious names of physicians, surgeons and physicists as von Mikulicz, Sauerbruch, Fell, O'Dwyer, Matas, Kuhn, Volhard, Hirsch, Sollman Robinson, Elsborg, Carrel, and others, except to observe that the thoracic region, formerly a *noli me tangere*, is now freely entered, and that many conditions formerly inoperable, from which patients had to die unrelieved, are to-day successfully coped with. Such are asphyxiation by drugs, smoke or immersion in water and such lesions as tuberculosis, abscess and gangrene of the lung; while the gullet, the aorta, the cardiac end of the stomach and so forth, can be reached with impunity.

We have now to describe the insufflation apparatus for intratracheal anesthesia devised (on the principles set forth) by Dr. H. H. Janeway. This is a portable apparatus for administering ether, capable of accurately gaging the supply of the latter, its dilution with warmed filtered air, and with mechanism for carefully regulating pressure and temperature. There is an electro-motor running on direct or alternating 110-volt current, the speed of which is adjustable by means of a rheostat. A positive pressure blower is connected to the motor's shaft, and has at its other end a worm gear which regulates the periods of rhythmic inflations (inhalations and exhalations) by a specially constructed slide valve actuated by this worm gearing. The pressure of the blower may be varied at will from nothing to 80 millimeters (Hg) if desired, and the air thus compressed passes through a muffler and filter whereby all impurities and odors are removed, noise being thus avoided as well. The filtered air passes by a special valve either directly over the surface of the water in the water jar (which is heated by an electric heater) or it may first pass over the surface of the ether in the ether jar, or through both jars at the same time, thus providing a perfect mixture. The amount of ether is controlled by a specially constructed spiral tube valve, which admits the air directly at the surface of the fluid (at any level, according to the amount of ether used). A valve placed between the two jars controls the air to enter the water or ether jar, or both. From the jars a pipe leads the ether-laden air to the time valve and branches off midway to a safety valve, which may be set for any pressure and will blow off any excess; a manometer connected to the blow-off valve, by the difference in the mercury columns, shows the amount of pressure delivered to the patient. A small catch basin serves to prevent the accumulation of any moisture in the breathing tube, and thus only filtered warm air is admitted into the patient's mouth. The electric water heater acts almost instantaneously, and a rheostat is provided for keeping the temperature fixed at a certain degree, which may however be varied at will by the use of an electric current switch. The apparatus has a very wide range of application because of its variable speed and variable pressure. For intratracheal insufflation low pressure below 20 millimeters is appropriate; while high pressure may be used in connection with a small cabinet, resembling a negative and positive chamber—an air-tight compartment into which, through an encircling elastic collar, the head of the patient is thrust for etherizing. The complete large apparatus weighs 45 pounds, and is 19 by 12 by 10 inches for hospital use; a smaller apparatus weighing 25 pounds is designed for private use and



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THE man who has passed through a nerve crisis—who has felt his grip slipping and has experienced the lamentable consequences of a nervous breakdown—and has found a welcome way back to better health through the remarkable powers of Sanatogen—

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You can have this assurance of real help for your nerves—the assurance of over 16,000 physicians who have written down their confidence in its power to rebuild and revitalize.

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The work of a physician author, beautifully illustrated, which tells you some really interesting things about your nervous system, facts which vitally affect your well-being and which therefore you ought to know. This book also tells the story of Sanatogen convincingly, from the point of view of a physician, so that any layman can understand it.

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Richmond Straight Cut Cigarettes

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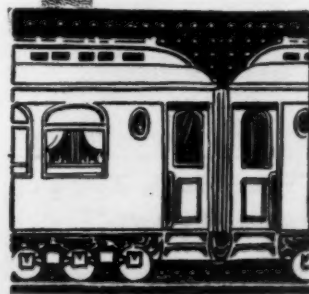
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Rumely Bulletin No. 4

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See next week's Bulletin

178

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Models and Experimental Work

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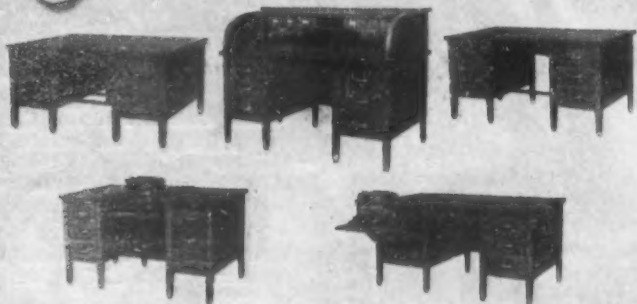
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OFFICE DESKS, SECTIONAL BOOKCASES, FILING DEVICES
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operates in a similar manner; both can easily be carried to a patient's bedside.

Forestry Erosion Processes

(Concluded from page 555.)

the model a tray from 4 to 7 feet square and 6 inches deep, having been at first waterproofed, is filled with 4 inches of rubble and earth, with the general slant of the surface toward the center of the front of the tray. Slight depressions are made as foundations for the two streams and for the two lakes. Over this is next placed 1 to 2 inches of mortar, consisting of one part cement and two parts sand. The stream beds and lake depressions are worked in before the mortar sets, taking care that the outlets of the lakes are only slightly lower than the intakes at the mouths of the streams. This cement, when dry, is waterproofed with hot paraffin, and a gutter is run along the front to receive the drippings of water as well as the runoff from the lakes. This water should empty into a waste pipe. In the rear of the model two mounds of earth, about $1\frac{1}{2}$ feet high, should be placed, with a depression between them. One of the mounds is covered thickly with moss, and through this small twigs or trimmings of hedges should be stuck to represent a forest. Stretches of nearly level land should extend from the bases of the hills to the lakes. The land below the forested hill should be covered with rich soil and that part adjacent to the stream and lake covered with moss to prevent washing. The other section should be barren and strewn with stones and small boulders.

New Information on Forest Fires

THE subject of Forest Service Bulletin 117 has been strikingly brought to the public mind during the last few years by reason of the exceptional number of extensive forest fires, which have arisen both on private and on public lands. The fact that the fall of 1910 was one of exceptional drought in the western United States accounts for the prevalence of these fires, but they occur to a greater or less extent every year, and are a source of inestimable loss to the people of this country. The present is an opportune time for the discussion of this subject, partly because of the extent of this enormous loss, but more because public attention may now be easily attracted, inasmuch as the general reader has recently been able to see and to figure out for himself the causes and the damage occasioned by these fires.

Mr. Fred G. Plummer, the geographer of the Forest Service and author of this bulletin, has considered the subject under the following headings: Sources and Scope of Information; Ancient Fires; Causes of Fires; Smoke Phenomena of Forest Fires; Historic Fires; Statistics of Damage and Loss.

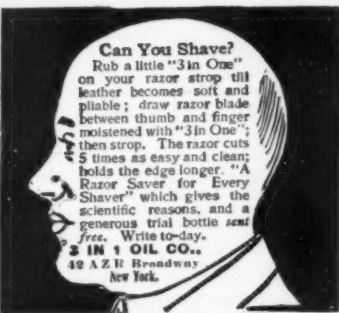
The report is based upon statistics received from every State and Territory in the Union and as far back as there are available records. Every bit of information was reduced to a common standard and a card system devised for use in future compilation of forest fire statistics. The figures given in the final table of forest fires in the United States, Canada and Newfoundland embrace a record of the causes and of the number of fires, total area burned, and the amount and value of timber consumed. Credit is given by the author to others who had previously gathered statistics on the subject, but Mr. Plummer has succeeded in bringing together the most complete record which is presented in the most compact and intelligent manner. The reader will be impressed with the great care and technical skill exhibited in the preparation of this new and real unique report. While the bulletin is necessarily technical in some parts, as for instance in the discussion which deals with smoke phenomena of forest fires, yet the non-technical reader will find a mass of data that will enable him to see for himself the great problem confronting the American people.

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THE TRUTH No. 3

The Interstate Commerce Commission at Washington, after two months' consideration of the accident at Westport, has recommended as follows:

"Railroads ought to unitedly experiment with the automatic train stop until a device of practicability for general use shall be available."

The accidents at Bridgeport in 1911 and at Westport in 1912 were exact duplicates. The engineers violated the rules of the road and passed all signals and warnings and went to their death carrying several passengers with them. Let us not blame them. Let us all co-operate to eliminate human error by mechanical device. The inventive genius of mankind has never yet paused before any public need. The need of the present, to more thoroughly safeguard life on even the best built and best equipped railroads, is that which the Interstate Commerce Commissioners recommend—an automatic train device that shall set the air brakes or close the steam throttle, or both, when a train fails to stop on signals.

The New York, New Haven & Hartford Railroad Co. hereby offers:

A REWARD OF \$10,000

TO BE PAID ON THE ORDER OF THE INTERSTATE COMMERCE COMMISSIONERS AND THE RAILROAD COMMISSIONERS OF MASSACHUSETTS AND THE PUBLIC UTILITIES COMMISSIONERS OF CONNECTICUT, TO WHOEVER SHALL FIRST INVENT AN AUTOMATIC DEVICE THAT WILL SAFELY ARREST AN EXPRESS STEAM LOCOMOTIVE THAT HAS PASSED DANGER SIGNALS; THE TEST OF EFFICIENCY TO BE ITS ADOPTION WITHIN THE YEAR 1913, 1914 OR 1915 BY THE NEW HAVEN ROAD, THE NEW YORK CENTRAL, OR THE PENNSYLVANIA AND ITS APPROVAL OR RECOMMENDATION BY THE INTERSTATE COMMERCE COMMISSIONERS.

CHARLES S. MELLEN

President

